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Economic, Environmental, and Benefits Analysis of the Final Metal Products & Machinery Rule

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Economic and Environmental Benefits Analysis Document For The Final Effluent Limitations Guidelines and Standards For The Metal Products & Machinery Point Source Category

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Executive Summary

Introduction

EPA is promulgating effluent limitations guidelines and standards for the Metal Products and Machinery (MP&M) industry. This document presents EPA's economic and environmental analyses supporting the final rule. The Executive Summary provides an overview of the costs and benefits of the regulation.

Overall, EPA finds that the final rule has modest economic impacts and benefits. The estimated social cost of the final rule is $13.8 million annually (2001$). The total benefits that can be valued in dollar terms in the categories traditionally analyzed for effluent guidelines range from around $1.0 to $1.5 million annually (2001$), based on alternative extrapolation methods.

EPA recognizes that estimates of both costs and benefits are uncertain. To supplement the national level analysis performed for the final MP&M regulation, EPA conducted a more detailed case study of the expected State-level costs and benefits of the MP&M rule in Ohio. In contrast to the national-level analysis, the more detailed case study analysis finds that the final regulation would achieve benefits substantially exceeding estimated social costs. Comparing the midpoint estimate of social costs ($62,232) with the midpoint estimate of monetizable benefits ($930,408) for Ohio, EPA estimates a net benefit of the final MP&M rule for Ohio is $868,178 (2001$).

EPA notes that effluent limitations guidelines for the MP&M industry are technology-based. EPA is neither required to demonstrate environmental benefits of its technology-based rules, nor is it required to consider receiving water quality in setting technology-based effluent limitations guidelines and standards. EPA considers benefits as one of the factors that the Agency evaluates.

Detailed descriptions of the analytic methodologies and results are presented in the Economic, Environmental, and Benefits Assessment for the Final Metal Products and Machinery Rule (EEBA). In addition, the EEBA presents costs, benefits, and economic impacts for alternatives to the final rule that were considered by EPA.

Executive Summary Contents

ES.1 Overview of Facilities Evaluated for Regulation under the MP&M Point Source Category and Its Effluent Discharges

The MP&M Point Source Category regulates oily operations process wastewater discharges to surface waters from existing or new industrial facilities (including facilities owned and operated by federal, state, or local governments) engaged in manufacturing, rebuilding, or maintenance of metal parts, products, or machines for use in the sixteen Metal Product & Machinery (MP&M) industrial sectors. Please note the underlined language in the previous sentence as a facility may be subject to the MP&M effluent guidelines even if it is not in one of the MP&M industrial sectors. For example, EPA considers a facility performing machining part of the "Bus & Truck" MP&M industrial sector if it manufactures metal parts for truck trailers. Process wastewater means wastewater as defined at 40 CFR parts 122 and 401, and includes wastewater from air pollution control devices (see 40 CFR 438.2(g)). Oily operations are listed at 40 CFR 438.2(g) and defined in Appendix B to Part 438 (see also Section 4 of the TDD).

According to Statistics of U.S. Business, 1996, approximately 638,696 establishments operate in the MP&M industry sectors. Based on information in the MP&M survey database, approximately 44,000 facilities meet the definition of an MP&M facility. These 44,000 facilities include approximately 41,000 indirect dischargers (i.e., facilities discharging effluent to a publicly-owned sewage treatment works or POTWs) and 3,000 direct dischargers (i.e., facilities discharging effluent directly to a waterway under a NPDES permit).

Table ES.1 reports the estimated number of MP&M facilities and total discharge flow (before final rule implementation) by type of facility. The largest number of sites, approximately 22,000, perform "rebuilding/maintenance only" and account for approximately 6 percent of the total estimated discharge flow for the industry. "Manufacturing only" contains the next largest number of facilities (15,400) and accounts, by far, for the largest percentage of the total estimated discharge flow for the industry (82 percent).

Table ES.1: Number of MP&M Facilities and Total Discharge Flow by Type of Facility

Type of Facility	Number of Facilities	Total Estimated Discharge Flow (million gal/yr)	Percent of Facilities	Percent of Total Discharge Flow
Manufacturing & Rebuilding/Maintenance	6,600	9,400	15.0%	12.0%
Manufacturing only	15,400	64,100	35.0%	82.0%
Rebuilding/Maintenance only	22,000	4,700	50.0%	6.0%
Total	44,000	78,200	100.0%	100.0%

Source: U.S. EPA analysis. See Section 4 of the Technical Development Document for the final rule.

Of the 43,858 water discharging facilities, 3,593 are predicted to close in the baseline, leaving 40,265 existing MP&M facilities that EPA estimates could be regulated.[1] After accounting for subcategory and discharger class exclusions, EPA estimates that the final rule will regulate 2,382 of these facilities, all of which are direct dischargers. These regulated facilities represent 5.9 percent of the 40,265 facilities that could be potentially regulated.

Table ES.2 summarizes information on the total number of MP&M facilities that were evaluated for the final rule, the number operating in the baseline, and the number and percent of facilities that will be regulated under the final rule. As reported in Table ES.2, no indirect dischargers are subject to the final regulation. The rule will regulate 2,382 direct dischargers in the Oily Wastes subcategory.

Table ES.2: Number of MP&M Facilities Evaluated for the Final Rule and Regulated under the Final Rule

Discharge Status	MP&M Facilities	Operating in the Baseline	Regulated under the Final Rule	Percent of Facilities Operating in the Baseline that are Regulated
Direct dischargers	2,739	2,641	2,382	90%
Indirect dischargers	41,162	37,652	0	0%
All dischargers	43,858	40,265	2,382	6%

Source: U.S. EPA analysis.

[1] These are facilities that are predicted to close due to weak financial performance under baseline conditions, i.e., in the absence of the final rule. EPA does not attribute the costs or the reduced discharges resulting from these baseline closures to the final rule, and therefore excludes these facilities from its analyses of the rule's impacts. Baseline closures account for differences between the universe of facilities discussed in this report and the universe discussed in the *Technical Development Document.*

Several aspects of the MP&M industries as a whole and part of those industries evaluated for regulation under the final rule are important in understanding the need for the regulation, the likely distribution and occurrence of benefits, and the framework of the economic analysis for the regulation.

Facilities in the relevant MP&M industries are located in every state, with a particular concentration in the heavy industrial regions along the Gulf Coast, both East and West Coasts and the Great Lakes Region. Moreover, MP&M facilities are frequently located in highly populated regions. Based on an analysis of in-scope sample facilities, around 35% of these facilities discharge to reaches located adjacent to counties with populations of at least 500 thousand people.[2]

Discharges of these pollutants to surface waters and POTWs have a number of adverse effects, including degradation of aquatic habitats, reduced survivability and diversity of native aquatic life, and increased human health risk through the consumption of contaminated fish and water.

Many MP&M facilities evaluated for the final regulation produce goods and services that serve multiple market sectors. It is not possible to associate regulatory costs and benefits to particular sectors, because EPA is not able to link regulated processes to specific sectors for facilities operating in multiple sectors. As a result, EPA's cost and economic impact analyses are disaggregated by type of facility but not by sector.

ES.2 Description of the Final Rule

In order to address variations between products, raw materials processed, and other factors that result in distinctly different effluent characteristics, EPA proposed eight groupings called "subcategories" for the January 2001 proposal and June 2002 Notice of Data Availability (NODA). EPA retained this subcategory structure for evaluating options for the final rule. Regulation of a category using subcategories allows each subcategory to have a uniform set of effluent limitations that take into account technological achievability and economic impacts unique to that subcategory (see Section 6 of the TDD). For the final rule, EPA is establishing limitations and standards only for direct dischargers in the Oily Wastes subcategory. The other seven subcategories (General Metals, Metal Finishing Job Shops, Non Chromium Anodizing, Printed Wiring Board, Railroad Line Maintenance, Shipbuilding Dry Docks, and Steel Forming & Finishing) were considered for regulation at proposal and for some of the alternative regulatory options, but are not further regulated under the final rule.

EPA is establishing BPT pH limitations and daily maximum limitations for two pollutants, oil and grease as hexane extractable material (O&G (as HEM)) and total suspended solids (TSS), for direct dischargers in the Oily Wastes subcategory based on the proposed technology option (Option 6). The technology requirements include the following treatment measures: (1) in-process flow control and pollution prevention; and (2) oil-water separation by chemical emulsion breaking and skimming (see Section 9 of the TDD). This technology is available technology readily applicable to all facilities in the Oily Wastes subcategory. Approximately 42% of the direct discharging facilities in the Oily Wastes subcategory currently employ this technology already.

EPA is promulgating BCT equivalent to BPT for facilities in the Oily Wastes subcategory and has decided not to establish BAT limitations. EPA is promulgating NSPS for new direct dischargers in the Oily Wastes subcategory at the BPT and BCT levels.

ES.3 Economic Impacts and Social Costs of the Final Rule

EPA assessed the economic impacts and social costs of the final rule using detailed financial and technical data from the MP&M surveys (see Section 3 of the TDD). Engineering analyses of these facilities identified the pollution prevention and treatment systems needed to comply with the final rule and other regulatory alternatives. The estimated capital and annual operating and maintenance costs of these systems, incremental to the costs of systems already in place, represent the

[2] EPA is not able to characterize the location characteristics of all potentially-regulated MP&M facilities at the national level precisely, because the MP&M survey design was not intended to provide national results by location characteristics.

compliance costs of the rule.[3] EPA analyzed the financial performance of the facilities evaluated for regulation under pre-regulation conditions (the baseline) and as subject to regulatory requirements. The Agency used a variety of measures to assess the economic impacts resulting from the final rule, both for the regulated MP&M facilities and for the firms and governments that own the facilities. The economic impact analysis also considered impacts for small entities in particular, and impacts on employment, foreign trade and communities. The results of the analyses for sample facilities were extrapolated using survey sample weights for each facility, to provide national-level results.

ES.3.1 Economic Impacts

Overall, EPA found the economic impact of the final rule to be modest. The following are EPA's findings for different categories of impacts.

a. Facility impacts

The facility impact analysis assesses how facilities will be affected financially by the final rule. Key outputs of the facility impact analysis include expected facility closures in the MP&M industries, associated losses in employment, and the number of facilities experiencing financial stress short of closure ("moderate impacts"). EPA performed economic impact analyses for three categories of facilities, using different methodologies to evaluate each of the groups. The three groups are:

- Private MP&M Facilities. This group includes privately-owned facilities that do not perform railroad line maintenance and are not owned by governments. This major category includes private businesses in a wide range of sectors or industries, including facilities that manufacture and rebuild railroad equipment. Only facilities that repair railroad track and equipment along the railroad line are not included.

- Railroad line maintenance facilities maintain and repair railroad track, equipment and vehicles.

- Government-owned facilities include MP&M facilities operated by municipalities, State agencies and other public sector entities such as State universities. Many of these facilities repair, rebuild, and maintain buses, trucks, cars, utility vehicles (e.g., snow plows and street cleaners), and light machinery.

The specific methodology used to assess impacts differed for each of the three types of MP&M facilities. For private MP&M facilities, EPA established thresholds for measures of financial performance and compared the facilities' performance before and after compliance with each regulatory option with these thresholds. Impacts were measured at the operating company level for railroad line maintenance facilities, since firms are unlikely to keep track of financial performance at the facility level for these sites. For governments, EPA compared compliance costs with facilities' baseline costs of service, and assessed the impact of the compliance costs on the government's taxpayers and on its ability to finance compliance costs by issuing debt.

EPA identified facilities that are financially weak and might be expected to close under baseline conditions. Of the estimated 43,858 discharging facilities, 8.2 percent or 3,593 facilities were assessed as baseline closures. The 3,593 baseline closures include 3,511 indirect dischargers, or 8.5 percent of indirect dischargers, and 98 direct dischargers, or 3.6 percent of direct dischargers. These facilities were excluded from the post-compliance analysis of regulatory impacts.

Table ES.3 summarizes the facility-level economic impact of the final rule. EPA estimates that the final rule will cause no facilities to close or to incur moderate financial stress short of closure. The final rule excludes all indirect discharging facilities and two percent of the direct discharging facilities from requirements.

[3] The annual equivalent of capital and other one-time costs is calculated by annualizing costs at a seven percent discount rate over an estimated 15 year equipment life. Annual compliance costs are annualized capital costs plus annual operating and maintenance (O&M) costs.

Table ES.3: Regulatory Impacts for All Facilities, Final Rule, National Estimates	Total[a]	Direct	Indirect
Number of facilities operating in the baseline: total	40,265	2,641	37,652
private MP&M and railroad line maintenance	*36,480*	*2,183*	*34,325*
government-owned	*3,785*	*458*	*3,327*
Number of facilities with subcategory exclusions	37,883	259	37,652
Percent of facilities operating in the baseline excluded or below cutoffs	94.1%	9.8%	100.0%
Number of facilities operating subject to regulatory requirements	2,382	2,382	0
Number of regulatory closures	0	0	0
Percent of facilities operating in the baseline that are regulatory closures	0.0%	0.0%	0.0%
Number of facilities experiencing moderate impacts	0	0	0
Percent of facilities operating in the baseline that experience moderate impacts	0.0%	0.0%	0.0%

[a] The total number of facilities does not sum to the number of facilities by subcategory because some facilities have an indirect and direct discharging operation within the same facility.

Source: U.S. EPA analysis.

Table ES.4 summarizes impacts for government-owned facilities in particular. Under the final rule, 88 percent of the government-owned facilities are excluded from requirements by subcategory exclusions. The compliance costs of the final rule do not result in significant budgetary impacts for any of the governments that operate MP&M facilities.

Table ES.4: Regulatory Impacts for Government-Owned Facilities, Final Rule, National Estimates	
Number of government-owned facilities operating in the baseline	3,785
Number of facilities with subcategory exclusions	3,327
Percent of facilities operating in the baseline excluded	88%
Number of facilities operating subject to regulatory requirements	458
Number of facilities experiencing significant budgetary impacts[a]	0
Percent of facilities operating in the baseline that experience significant budgetary impacts	0%

[a] A government is judged to experience major budgetary impacts if (1) any of its MP&M facilities incur compliance costs exceeding 1% of baseline cost of service and (2) the government fails both the taxpayer impact and debt impact tests.

Source: U.S. EPA analysis.

b. Firm-level impacts

EPA examined the impacts of the final rule on firms that own MP&M facilities, as well as on the financial condition of the facilities themselves. A firm that owns multiple MP&M facilities could experience adverse financial impacts at the firm level if its facilities are among those that incur significant impacts at the facility level. The firm-level analysis is also used to assess impacts on small firms, as required by the Regulatory Flexibility Act.

EPA compared compliance costs with revenue at the firm level as a measure of the relative burden of compliance costs. EPA applied this analysis only to MP&M facilities owned by private entities. EPA estimated firm-level compliance costs by summing costs for all facilities owned by the same firm that responded to the survey plus estimated compliance costs for additional facilities for which respondents submitted voluntary information. The Agency was not able to estimate the national numbers of firms that own MP&M facilities precisely, because the sample weights based on the survey design represent numbers of facilities rather than firms. Most MP&M facilities (26,472 of 36,480, or 73 percent) are single-facility firms, however. These firms can be analyzed using the survey weights. In addition, from survey responses, EPA identified 389 sample facilities that are owned by 276 multi-facility firms. It is not known how many multi-facility firms exist at the national level, so EPA included these 276 firms in the firm-level analysis without extrapolation to the national level.

Table ES.5 shows the results of the firm-level analysis. The results represent a total of 26,748 MP&M firms (26,472 + 276), owning 26,861 facilities (26,472 owned by single-facility firms + 389 owned by multi-facility firms).

Table ES.5: Firm Level Before-Tax Annual Compliance Costs as a Percent of Annual Revenues

Number of Firms in the Analysis[a]	Number and Percent with Before-Tax Annual Compliance Costs/Annual Revenues Equal to:					
	0%		>0% and <1%		Over 1%	
	Number	%	Number	%	Number	%
26,748	25,722	96.2%	1,027	3.8%	0	0%

[a] Firms whose only MP&M facilities close in the baseline are excluded.

Source: U.S. EPA analysis.

None of the firms in the analysis incur after-tax costs of greater than 1 percent of their annual revenues. Of the 1,027 firms that incur any costs at all, none own facilities that close or experience moderate impacts as a results of the final rule.

This analysis is likely to overstate costs at the firm level because it does not consider the actions a multi-facility firm might take to reduce its compliance costs under the final rule, such as transferring functions among facilities to consolidate wet processes and to take advantage of scale economies in wastewater treatment.

c. Employment effects

Potential changes in employment from the rule include: (1) job losses that occur when facilities close and (2) job gains resulting from facilities' compliance activities. EPA estimates that the final rule will cause no facilities to close and therefore the final rule will cause no job losses. EPA estimates that the regulation will increase employment, with the manufacture and installation of compliance equipment causing a short-term gain in direct employment of 20 FTEs. In addition, EPA estimates that operation and maintenance of compliance equipment will cause a continuing direct requirement for 2 FTEs per year. The net effect on direct employment of the regulation is an estimated increase in 47 FTE-years, a measure that reflects both the number and duration of jobs gained. Over the 15 year analysis period, the employment gain averages 3 FTEs per year.

d. Community impacts

EPA also considered the potential impacts of changes in employment due to the regulation on the communities where MP&M facilities are located. Given that no closures are predicted due to the final rule, EPA does not expect the rule to have significant impacts at the community level.

e. Foreign trade impacts

The foreign trade impacts analysis allocates the value of changes in output for each facility that is projected to close to exports, imports, or domestic sales, based on the dominant source of competition in each market as reported in the surveys. EPA does not expect any foreign trade impacts as a result of the final rule because no facility closures are expected.

f. Impacts on new facilities

The new facility analysis assessed whether revised or new discharge limits for newly constructed sources would create a barrier to entry by new businesses and new facilities. To assess the potential for barrier to entry, EPA compared, by subcategory and discharger status, the estimated annual incremental costs of meeting revised new source limits with the estimated annual revenue of new facilities. EPA based the estimates of annual revenue and incremental costs of meeting revised new source limits on information from the existing facility database. EPA used the findings from this analysis, in terms of the estimated percentages of new facilities that would incur costs exceeding specified revenue thresholds, to decide whether to issue revised new source limits for the various industry subcategories and discharger classes. From this analysis, EPA concluded that the promulgation of revised new source limits for the Oily Wastes direct discharger subcategory would not create a barrier to entry and this information, in part, underlies EPA's decision to promulgate new source limits for this subcategory as part of the final regulation.

g. Impacts on small entities

Table ES.6 shows the total number of facilities operating in the baseline and the number owned by small entities. Overall, approximately 73 percent of all MP&M facilities are owned by small entities. However, subcategory exclusions in the final rule will exclude approximately 95 percent of the facilities owned by small entities.

Table ES.6: Number and Percent of MP&M Facilities Owned by Small Entities

Type of Facility	Number of Facilities of all Sizes Operating in the Baseline	Number of Facilities Owned by Small Entities	Percent of Facilities Owned by Small Entities
Private MP&M[a]	36,480	27,418	75%
Government-owned	3,785	1,962	52%
Total[a]	40,265	29,380	73%

[a] Excludes baseline closures

Source: U.S. EPA analysis.

EPA assessed impacts on small entities by comparing compliance costs to revenues for the small entities at the firm level and by analyzing the facility impact analysis results for facilities owned by small firms. These analyses indicate that no facilities will incur costs exceeding 1% of revenues, and only 1,019 facilities owned by small firms will incur any costs at all. None of these facilities incur moderate impacts or close as a result of the final rule.

EPA estimates that 1,962 facilities are owned by small governments (those with populations less than 50,000). The subcategory exclusions in the final rule exclude 1,682 of these small government-owned MP&M facilities. Thus, the final rule covers 280 small government-owned facilities. Of these facilities, only 140 incur costs, and the average annual cost per facility is less than $30,000. All of the 140 facilities have costs less than 3 percent of baseline cost of service. EPA estimated no significant impacts for any of these facilities or the governments that own them, based on the analysis of change in site cost of service, impact on taxpayers, and impact on government debt levels. The total compliance cost for all the small government-owned facilities incurring costs under the final rule is $3.5 million.

ES.3.2 Social Costs

The social costs of the final rule represent the value of society's resources used to comply with and administer the rule. EPA estimated three categories of social cost for the final regulation:

- the cost of society's economic resources used to comply with the final regulation,
- the cost to governments of administering the final regulation, and
- the social costs of unemployment resulting from the regulation.

Resource costs of compliance are the value of society's productive resources including labor, equipment, and materials expended to achieve the reductions in effluent discharges required by the final rule. The social costs of these resources are generally higher than the cost burden to facilities because facilities are able to deduct the costs from their taxable income and may offset some of the costs through increased prices to customers. The costs to society, however, are the full value of the resources used, whether they are paid for by the regulated facilities, by all taxpayers in the form of lost tax revenues, or passed on to customers through increased prices.

The main cost to government from administering the regulation is the cost to POTWs for writing permits, and for compliance monitoring and enforcement activities. POTWs could incur costs in writing new permits for previously unpermitted facilities, and writing revised permits for some facilities earlier than would otherwise be required. Because the final regulation excludes all indirect dischargers from coverage, EPA expects that the final rule will not increase POTW administrative costs.

The loss of jobs from facility closures would represent a social cost of the regulation. From its facility impact analysis, EPA estimates that no facilities will close as a result of the regulation. Accordingly, EPA estimates a zero cost of unemployment for the final rule. EPA did not recognize possible savings in unemployment-related costs from jobs created by the rule as a negative cost (benefit) of the regulation.

From this analysis EPA estimated a total annual social cost of $13.8 million annually (2001$) for the final rule (see Table ES.7). All of this cost results from the estimated resource cost of compliance.

Table ES.7: Total Social Cost: Final Rule (millions, 2001$)

Social Cost Categories	Final Rule
Resource cost of compliance expenditures	$13.8
Costs to POTWs of administering the rule	$0.0
Social costs of unemployment	$0.0
Total Social Cost	$13.8

Source: U.S. EPA analysis.

ES.4 National Benefits of the Final Rule

The final regulation will reduce MP&M industry pollutant discharges to the nation's surface waters with a number of consequent benefits to society, including:

- improved quality of freshwater, estuarine, and marine ecosystems;
- increased survivability and diversity of aquatic and terrestrial wildlife; and
- reduced risks to human health through consumption of fish or water taken from affected waterways.

Table ES.8 shows EPA estimates for reduction in pollutant discharges to U.S. waters under the final rule. Loadings are shown both in pounds of pollutant and in toxic-weighted pound equivalents. The latter measure reflects the relative toxicity of the various toxic pollutants. The regulation would result in a 80 percent reduction in total toxic-weighted pollutant lbs. equivalent per year. The estimated toxic weighted pollutant reductions range from 87 percent for priority metal pollutants to 1 percent for arsenic. Reductions in pounds of pollutants (not toxic-weighted) range from 93 percent for oil and grease (O&G) to 5 percent for arsenic. As shown in Table ES.8, the final rule achieves modest reductions for arsenic, organics, biological oxygen demand (BOD), and chemical oxygen demand (COD), and significant reductions for toxic metals, other inorganics, bulk pollutants, and oil and grease.

Table ES.8: Summary of Discharges by Pollutant Type for Regulated MP&M Facilities[a]

Pollutant Category	Current Releases		Releases under the Final Rule		Percent Reduction Due to the Final Rule	
	Pounds	Pounds Eq.	Pounds	Pounds Eq.	Pounds	Pounds Eq.
Priority Pollutants						
Metals	794	2,756	153	351	80.7%	87.3%
Organics	336	58	268	45	20.2%	22.4%
Arsenic	22	75	21	74	4.5%	1.3%
Cyanide (CN)	0	0	0	0	-	-
Nonconventional Pollutants						
Metals	25,863	417	16,428	158	36.5%	62.1%
Organics	2,159	45	1,038	39	51.9%	13.3%
Other inorganics	2,334	0.2	1,301	0.1	44.3%	50.0%
Bulk pollutants	335,679		167,295		50.2%	
Conventional Pollutants						
BOD	263,419		165,567		37.1%	
COD	523,440		488,697		6.6%	
O&G	428,137		28,955		93.2%	
TSS	160,695		73,769		54.1%	
Total		3,351		667		80.1%

[a] Includes only direct discharging facilities in the Oily Wastes subcategory that continue to operate in the baseline and that are subject to the final rule.

Source: U.S. EPA analysis.

EPA assessed the benefits from the expected pollutant reductions in three broad classes: human health, ecological, and productivity benefits.[4] EPA was able to assess benefits within these three classes with varying degrees of completeness and rigor. Where possible, EPA quantified the expected effects and estimated monetary values. Some benefit categories could not be monetized because of data limitations and a limited understanding of how society values certain water quality changes.

EPA used sample facility data to estimate national benefits from the regulation. The Agency extrapolated findings from the sample facility analyses to the national level using two extrapolation methods: (1) traditional extrapolation and (2) post-stratification extrapolation. EPA traditionally uses a standard linear weighting technique (i.e., traditional extrapolation) to estimate national compliance costs, changes in pollutant removals, and national-level benefits of environmental regulations. However, using sample weights that are based only on facility-specific (e.g., engineering) characteristics without including non-facility factors can lead to a conditional bias in the estimation of national-level benefits. In particular, this approach omits consideration of important non-facility factors that influence the occurrence and size of benefits. Non-facility factors that are likely to affect the occurrence and size of benefits from reduced sample facility discharges and that are not reflected in the standard stratification and sample-weighting approach include the receiving water body type and size and the size of population residing in the vicinity of a sample facility. To address omission of these important non-facility factors (i.e., water body type and size, affected population, and co-occurrence MP&M discharges) in designing the MP&M facilities sample, EPA adjusted sampling weights through post-stratification using two variables: (1) receiving water body type and size and (2) the size of the population residing in the vicinity of the sample facility. The Agency used a commonly used post-

[4] EPA evaluated two productivity measures: (1) the reduction in pollutant interference at POTWs, and (2) pass-through of pollutants into the sludge, which limits options for POTW disposal of sewage sludge. Because the final rule only regulates direct discharges and thus does not affect POTW operations, productivity benefits were evaluated for alternative options only.

stratification method called "raking" to adjust original sample weights to reflect these benefits characteristics. Appendix G of this report provides detail on extrapolation methods used in this analysis.

To supplement the national-level analysis performed for the final MP&M regulation, EPA also conducted a detailed case study of the expected state-level costs and benefits of the MP&M rule in Ohio. For several reasons, EPA judges that the Ohio case study is more robust than the national benefit analyses that EPA undertakes in support of effluent guideline development. These reasons include: (1) use of more detailed data on MP&M facilities than is possible at the national level; (2) use of more detailed and accurate water quality data than are usually available; (3) more accurate accounting for the presence and effect of multiple discharges to the same reach; (4) inclusion of data on non-MP&M discharges in the baseline and post compliance; (5) use of a first-order decay model to estimate in-stream concentrations in downstream water bodies; and (6) inclusion of an additional recreational benefit category (swimming) in the analysis. The Ohio case study analysis is presented in Chapters 20, 21, and 22 of this report.

ES.4.1 Reduced Human Health Risk

EPA estimates that the final rule will prevent discharge of 18 pounds per year of carcinogens and 119 pounds per year of lead. Also, the final rule will prevent discharge of an additional 6,900 pounds of 76 pollutants of concern that are known to cause adverse human health effects. These reduced pollutant discharges from MP&M facilities are expected to result in reduced risk of illness from consumption of contaminated fish, shellfish, and water.

EPA analyzed the following measures of health-related benefits: reduced cancer risk from fish and water consumption; reduced risk of non-cancer toxic effects from fish and water consumption; lead-related health effects to children and adults; and reduced occurrence of in-waterway pollutant concentrations in excess of levels of concern. The levels of concern include human health-based ambient water quality criteria (AWQC) or documented toxic effect levels for those chemicals not covered by water quality criteria. Although some health effects are relatively well understood and can be quantified and monetized in a benefits analysis (e.g., cancer), others are less well understood, and may not be assessed with the same rigor or at all (e.g., systemic health effects). The Agency therefore monetized only two of these health benefits: (1) changes in the incidence of cancer from fish and water consumption, and (2) changes in adverse health effects in children and adults from reduced lead exposure.

The national-level analysis of human health benefits finds negligible monetized benefits from the final rule. However, because of significant simplifications in the national level analysis, this finding should be recognized as potentially having substantial error and should therefore be interpreted with caution. In particular, the national-level analysis: (1) is based only on limited information on MP&M facilities at the national level; (2) accounts in only a very limited way for the presence and effect of joint discharges on the same reach; (3) omits data on non-MP&M discharges in the baseline and post compliance; and (4) omits consideration of the downstream effects of pollutant discharges.

In contrast to the national-level analysis, the methods and data used for the Ohio case study address a number of these analytic weaknesses. This more rigorous analysis finds that the final regulation would achieve $0.5 million (2001$) in health-related benefits in the state of Ohio alone. EPA estimates that this analysis provides a more accurate, albeit lower-bound, estimate of health-related benefits than indicated by the simpler national-level analysis. Moreover, given (1) that Ohio represents only about 6 percent of the total MP&M facility population and (2) that a substantial share of the total MP&M facility population is located in other states with similar water body and population characteristics (e.g., the states of Illinois, Indiana, Michigan, Pennsylvania), it is reasonable to expect that additional human health benefits would be estimated for the remainder of the country if EPA were able to apply this more rigorous approach at the national level. Accordingly, EPA judges that the final rule's human health benefits are higher than its social costs.

a. Benefits from reduced incidence of cancer cases

EPA assessed changes in the incidence of cancer cases from consumption of MP&M pollutants in fish tissue and drinking water. The methodology for assessing human health benefits from reduced cancer incidence is presented in Chapter 13 of this report. The Agency valued changes in incidence of cancer cases using a willingness-to-pay (WTP) of $6.5 million (2001$) for avoiding premature mortality. This estimate of the value of a statistical life saved is recommended in EPA's Guidelines for Preparing Economic Analysis. This estimate does not include estimates of WTP to avoid morbidity prior to death.

EPA estimated aggregate cancer risk from contaminated drinking water for populations served by drinking water intakes on water bodies to which MP&M facilities discharge. EPA based this analysis on six carcinogenic pollutants for which drinking water criteria have not been published.[5] This analysis excludes seven carcinogens for which drinking water criteria have been published. EPA assumed that public drinking water treatment systems will remove these pollutants from the public water supply. To the extent that treatment for these seven pollutants may cause incidental removals of the chemicals without criteria, the analysis may overstate cancer-related benefits.

Calculated in-stream concentrations provide the basis for estimating changes in cancer risk for populations served by affected drinking water intakes. EPA estimates that baseline MP&M discharges from in-scope facilities are associated with virtually zero annual cancer cases. The national-level analysis finds that the final regulation would lead to a marginal reduction in these cancer cases resulting from consumption of contaminated drinking water; correspondingly, monetary benefits estimated from reduced consumption of contaminated drinking water are essentially zero.

EPA also estimated cancer risk from the consumption of contaminated fish for recreational and subsistence anglers and their families. EPA based this analysis on thirteen carcinogenic pollutants found in MP&M effluent discharges. Estimated contaminant concentrations in fish tissue are a function of predicted in-stream pollutant concentrations and pollutant bioconcentration factors. EPA used data on numbers of licensed fishermen by state and county, presence of fish consumption advisories, number of fishing trips per person per year, and average household size to estimate the affected population of recreational and subsistence anglers and their families. The analysis uses different fish consumption rates for recreational and subsistence anglers to estimate the change in cancer risk among these populations.

EPA estimated that baseline MP&M discharges from in-scope facilities are associated with 0.03 annual cancer cases. The national-level analysis shows that the final option would lead to a marginal reduction in cancer cases among recreational and subsistence angler populations. The monetary benefits estimated from consumption of less contaminated fish by these populations are essentially negligible.

The findings from the national analysis of changes in cancer risk for the final rule differ from the Ohio case study results. Based on the Ohio case study, the final option is expected to eliminate 0.01 cancer cases annually in the State of Ohio alone. This reduction translates into $14,500 (2001$) in annual benefits due to reduced cancer risk from consumption of contaminated fish tissue and drinking water (see Chapter 22 of this report for detail).

The difference in the findings of the national and Ohio analyses results primarily from more comprehensive information on MP&M and non-MP&M facility discharges used in the Ohio case study analysis. The national-level analysis accounts only for the pollutant exposures from MP&M sample facilities. In contrast, the Ohio case study approach accounts for a broader baseline of pollutant exposure, including more thorough and detailed coverage of discharges from MP&M facilities and also estimated exposures from non-MP&M sources. As a result, the Ohio case study analysis more accurately reflects baseline health risk conditions.

b. Reductions in systemic health effects

The final rule can potentially achieve a wide range of non-cancer human health benefits (e.g., systemic effects, reproductive toxicity, and developmental toxicity) from reduced contamination of fish tissue and drinking water sources. The common approach for assessing the risk of non-cancer health effects from the ingestion of a pollutant is to calculate a hazard quotient by dividing an individual's oral exposure to the pollutant, expressed as a pollutant dose in milligrams per kilogram body weight per day (mg/kg-day), by the pollutant's oral reference dose (RfD). An RfD is defined as an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure that likely would not result in the occurrence of adverse health effects in humans, including sensitive individuals, during a lifetime. A hazard quotient less than one means that the pollutant dose to which an individual is exposed is less than the RfD, and, therefore, presumed to be without appreciable risk of adverse human health effects. EPA guidance for assessing exposures to mixtures of pollutants recommends calculating a hazard index (HI) by summing the individual hazard quotients for those pollutants in the mixture that affect the same target organ or system (e.g., the kidneys, the respiratory system). HI values are interpreted similarly to hazard quotients; values below one are generally considered to suggest that exposures are not likely to result in appreciable risk of adverse health effects during a lifetime, and values above one are generally cause for concern, although an HI greater than one does not necessarily suggest a likelihood of adverse effects. Chapter 13 of this report provides a detailed discussion of the methodology for assessing changes in systemic health effects associated with this rule.

[5] EPA included n-nitrosodimethylamine (NDMA) in its assessment of the baseline incidence of cancer cases. However, the Agency did not consider NDMA pollutant reductions in its benefits analysis due to limited wastewater sampling for that pollutant.

To evaluate the potential benefits of reducing the in-stream concentrations of 76 pollutants that cause non-cancer health effects, EPA estimated target organ-specific HIs for drinking water and fish ingestion exposures in both the baseline and post-compliance scenarios. Specifically, EPA calculated target-organ specific HIs for pollutants predicted in each MP&M discharge reach; as a result, a separate HI was calculated for each target organ/exposure pathway (fish consumption and drinking water)/reach combination. EPA then combined estimates of the numbers of individuals in the exposed populations with the HIs for the populations to determine how many individuals might be expected to realize reduced risk of non-cancer health effects in the post-compliance scenario.

The results of EPA's analysis suggest that hazard indices for individuals in the exposed populations may decrease after facilities comply with today's rule. Increases in the percentage of exposed populations that would be exposed to no risk of non-cancer adverse human health effects due to the MP&M discharges occur in both the fish and drinking water analyses. The shift to lower hazard indices should be considered in conjunction with the finding that the hazard indices for incremental exposures to pollutants discharged by MP&M facilities (for which reference doses are available) are less than one in the baseline analysis for the entire population associated with sample facilities. Whether the incremental shifts in hazard indices are significant in reducing absolute risks of non-cancer adverse human health effects is uncertain and will depend on the magnitude of contaminant exposures for a given population from risk sources not accounted for in this analysis.

c. Benefits from reduced exposure to lead

EPA performed a separate analysis of benefits from reduced exposure to lead. This analysis differs from the analysis of non-cancer adverse human health effects from exposure to other MP&M pollutants because it is based on dose-response functions tied to specific health endpoints to which monetary values can be applied. Chapter 14 of this report presents the methodology for assessing benefits from reduced exposure to lead.

Many lead-related adverse health effects are relatively common and are chronic in nature. These effects include, but are not limited to, hypertension, coronary heart disease, and impaired cognitive function. Lead is harmful to individuals of all ages, but the effects of lead on children are of particular concern. Children's rapid rate of development makes them more susceptible to neurobehavioral effects from lead exposure. The neurobehavioral effects on children from lead exposure include hyperactivity, behavioral and attention difficulties, delayed mental development, and motor and perceptual skill deficits.

This analysis assessed benefits of reduced lead exposure from consumption of contaminated fish tissue to three sensitive populations: (1) preschool age children; (2) pregnant women; and (3) adult men and women. This analysis uses blood-lead levels as a biomarker of lead exposure. EPA estimated baseline and post-compliance blood lead levels in the exposed populations and then used changes in these levels to estimate benefits in the form of avoided health damages.

EPA assessed neurobehavioral effects on children based on a dose response relationship for IQ decrements. Avoided neurological and cognitive damages are expressed as changes in overall IQ levels, including reduced incidence of extremely low IQ scores (<70, or two standard deviations below the mean) and reduced incidence of blood-lead levels above 20 mg/dL. The analysis uses the value of compensatory education that an individual would otherwise need and the impact of an additional IQ point on individuals' future earnings to value the avoided neurological and cognitive damages. The national-level analyses shows that implementation of the final option would not result in any changes in IQ loss across all exposed children. The final option does not reduce occurrences of extremely low IQ scores (<70) or incidences of blood-lead levels above 20 mg/dL.

Prenatal exposure to lead is an important route of exposure. Fetal exposure to lead in utero due to maternal blood-lead levels may result in several adverse health effects, including decreased gestational age, reduced birth weight, late fetal death, neurobehavioral deficits in infants, and increased infant mortality. To assess benefits to pregnant women, EPA estimated changes in the risk of infant mortality due to changes in maternal blood-lead levels during pregnancy. The national-level analysis shows that the final option does not result in changes in maternal blood lead levels during pregnancy and as a result does not reduce neonatal mortality.

The national-level analysis finds no benefits to children from reduced exposure to lead. However, as for the cancer risk analysis previously discussed, these findings differ from the more comprehensive analysis used in the Ohio case study. Using the more rigorous case study approach, EPA estimates that the final regulation will yield annual lead-related benefits for children in Ohio of $422,113 (2001$). This benefit value includes three components. First, reduced lead exposure is estimated to reduce neonatal mortality by 0.024 cases annually with an annual value of $162,094 (2001$). Second, reduced lead exposure will avoid the loss of an estimated 26.96 IQ points among preschool children in Ohio, which translates into

$253,934 (2001$) per year in benefits. Third, the annually avoided costs of compensatory education from incidence of IQ below 70 and blood-lead levels above 20 g/dL among children amounts to approximately $5,345 (2001$).

Lead exposure has been shown to have adverse effects on the health of adults as well as children. The health effects in adults that EPA quantified all derive from lead's effects on blood pressure. Quantified health effects include increased incidence of hypertension (estimated for males only), initial coronary heart disease (CHD), strokes (initial cerebrovascular accidents and atherothrombotic brain infarctions), and premature mortality. This analysis does not include other health effects associated with elevated blood pressure and other adult health effects of lead, including nervous system disorders, anemia, and possible cancer effects. EPA used cost of illness estimates (i.e., medical costs and lost work time) to estimate monetary value of reduced incidence of hypertension, initial CHD, and strokes. EPA then used the value of a statistical life saved to value changes in risk of premature mortality. The national-level analysis finds that the final rule will achieve no lead-related health benefits among adults.

Again, the national analysis results differ from the Ohio case study results. Using the case study approach, EPA estimates that the final regulation will achieve total lead-related benefits among Ohio adults of $117,393 (2001$). This value includes benefits from reduced hypertension among adult males: a reduction of an estimated 9.4 cases annually, with benefits of approximately $10,670 (2001$). In addition, reducing the incidence of initial CHD, strokes, and premature mortality among adult males and females in Ohio would result in estimated benefits of $963, $2,115, and $103,645, respectively (see Chapter 22 of this report for detail).

Based on the national-level benefits analysis, EPA found that total benefits from reduced exposure to lead, for both children and adults, are negligible under the final rule. However, based on the Ohio case study findings, benefits for children and adults from reduced lead-related health effects of the final rule are estimated to total approximately $0.5 million (2001$) annually in the state of Ohio alone (see Section H of today's final rule for detail). As in the cancer risk analysis, the difference in the national and Ohio-based findings stems primarily from more comprehensive information on MP&M and non-MP&M facility discharges used in Ohio.

d. Exceedances of human health-based AWQC

EPA also estimated the effect of MP&M facility discharges on the occurrence of pollutant concentrations in affected waterways that exceed human health-based AWQCs. In a conceptual sense, this analysis and its findings are not additive to the preceding analyses of change in cancer or lead-related health risks but are another way of quantitatively characterizing the same possible benefit categories. This analysis compares the estimated baseline and post-compliance in-stream pollutant concentrations in affected waterways to ambient water criteria for protection of human health. The comparison included AWQC for protection of human health through consumption of organisms and consumption of water and organisms. Pollutant concentrations in excess of these values indicate potential risks to human health.

EPA estimates that in-stream concentrations of 4 pollutants (i.e., arsenic, iron, manganese, and n-nitrosodimethylamine) will exceed human health criteria for consumption of water and organisms in 78 receiving reaches nationwide as the result of baseline MP&M pollutant discharges. EPA estimates that 23% of human health AWQC exceedances are caused by n-nitrosodimethylamine (NDMA). EPA did not consider NDMA pollutant reductions in its benefits analyses due to limited wastewater sampling data for that pollutant. EPA estimates that the final rule will not eliminate the occurrence of concentrations in excess of human health criteria for consumption of water and organisms and for consumption of organisms on any of the reaches on which baseline discharges are estimated to cause concentrations in excess of AWQC values.

ES.4.2 Ecological, Recreational, and Nonuser Benefits

EPA expects the MP&M rule to improve aquatic species habitats by reducing concentrations of toxic contaminants such as aluminum, cadmium, copper, lead, mercury, silver, and zinc in water. These improvements should enhance the quality and value of water-based recreation, such as fishing, swimming, wildlife viewing, camping, waterfowl hunting, and boating. The benefits from improved water-based recreation would be seen as increases in the increased value participants derive from a day of recreation and the increased number of days that consumers of water-based recreation choose to visit the cleaner waterways. This analysis measures the economic benefit to society from water quality improvements based on the increased monetary value of recreational opportunities resulting from those improvements

a. Reduced aquatic life impacts

EPA quantified the ecological improvements of the final regulation by comparing estimates of in-waterway concentrations of pollutants discharged by MP&M facilites with AWQC values for protection of aquatic species. Pollutant concentrations in excess of acute and/or chronic AWQC limits for protection of aquatic life indicate potential adverse impacts to aquatic species. EPA estimates that baseline in-stream concentrations of 9 pollutants (i.e., aluminum, cadmium, copper, lead, manganese, mercury, nickel, silver, and zinc) will exceed the acute and chronic criterion for aquatic life in 353 reaches nationwide. The final rule eliminates concentrations in excess of aquatic life AWQCs on nine of these reaches. EPA's analysis shows that none of the receiving reaches exceeding chronic or acute aquatic life AWQC at the baseline discharge level will experience partial water quality improvements from reduced occurrence of AWQC exceedances for some pollutants.

b. Recreational benefits

EPA assessed the recreational benefits from reduced occurrence of pollutant concentrations exceeding aquatic life and/or human health AWQC values. Combining its findings from both the aquatic life and human health AWQC exceedance analyses, EPA found that 394 stream reaches exceed chronic or acute aquatic life AWQC and/or human health AWQC values at baseline discharge levels. The Agency estimates that the final rule will eliminate exceedances on nine of these discharge reaches, leaving 384 reaches with concentrations of one or more pollutants exceeding AWQC limits. None of these 384 reaches will experience partial water quality improvements from reduced occurrence of some pollutant concentrations in excess of AWQC limits.

EPA attached a monetary value to reduced exceedances based on increased values for three water-based recreation activities (fishing, wildlife viewing, and boating) and on nonuser values. EPA applied a benefits transfer approach to estimate the total WTP, including both use and nonuse values, for improvements in surface water quality. This approach builds upon a review and analysis of the surface water valuation literature.

EPA first estimated the baseline value of water-based recreation for benefiting reaches, based on per-reach estimates of:

- annual person-days of water-based recreation, and
- per-day values of water-based recreation.

The baseline per-day values of water-based recreation are based on studies by Walsh et. al (1992) and Bergstrom and Cordell (1991). The studies provide values per recreation day for a wide range of water-based activities, including fishing, boating, wildlife viewing, waterfowl hunting, camping, and picnicking. The mean values per recreational fishing, boating, and wildlife viewing day used in this analysis are $42.12, $48.30 and $26.28 (2001$), respectively. Applying facility weights and summing over all benefiting reaches provides a total baseline value for a given recreational activity for MP&M reaches expected to benefit from the elimination of pollutant concentrations in excess of AWQC limits.

EPA then applied the percentage change in the recreational value of water resources implied by surface water valuation studies to estimate changes in values for all MP&M reaches in which the regulation eliminates AWQC exceedances by one or more MP&M pollutants. The Agency selected eight of the most comparable studies and calculated the changes in recreation values from water quality improvements (as percentage of the baseline) implied by those studies. Sources of estimates included Lyke (1993), Jakus et al. (1997), Montgomery and Needleman (1997), Paneuf et al. (1998), Desvousges et al. (1987), Lant and Roberts (1990), Farber and Griner (2000), and Tudor et al. (2002). EPA's reasoning for selecting each study is discussed in detail in Chapter 15 of this report. EPA took a simple mean of point estimates from all applicable studies to derive a central tendency value for percentage change in the water resource values due to water quality improvements. These studies yielded estimates of increased recreational value from water quality improvements expected from reduced MP&M

discharges of 12, 9, and 18 percent for fishing, boating, and wildlife viewing respectively. Using all possible applicable valuation studies in developing a benefits transfer approach to valuing changes in the recreational value of water resources from reduced MP&M discharges, makes unit values more likely to be nationally representative, and avoids the potential bias inherent in using a single study to make estimates at the national level.

Table ES.9 presents the estimated national recreational benefits of the final rule (2001$). The estimated increased value of recreational activities to users of water-based recreation is $537,197, $202,691, and $259,949 annually for fishing, boating, and wildlife viewing, respectively. The recreational activities considered in this analysis are stochastically independent; EPA calculated the total user value of enhanced water-based recreation opportunities by summing over the three recreation categories. The estimated increase in the total user value is $999,838 annually.

EPA also estimated non-market nonuser benefits. These non-market nonuser benefits are not associated with current use of the affected ecosystem or habitat; instead, they arise from the value society places on improved water quality independent of planned uses or based on expected future use. Past studies have shown that nonuser values are a sizable component of the total economic value of water resources. EPA estimated average changes in nonuser value to equal one-half of the recreational use benefits based on study by A. Fisher and R. Raucher (1984). The estimated increase in nonuse value is $499,919 (2001$).

A recent literature review finds that nonuse benefits are, on average, 1.9 to 2.5 times all use values, rather than 0.5 times recreational benefits alone as EPA has traditionally assumed for its nonuse benefit estimates (T. Brown, 1993). EPA's method for estimating nonuse benefits from water quality improvements resulting from reduced MP&M discharges is therefore likely to understate the true value of nonuse benefits.

Table ES.9: Estimated Recreational Benefits from Reduced MP&M Discharges (thousands, 2001$)

Recreational Activity	Traditional Extrapolation	Post-Stratification Extrapolation
Recreational fishing	$537	$350
Recreational boating	$203	$132
Wildlife viewing and near-water recreation	$260	$169
Total recreational use benefits (fishing + boating + wildlife viewing)	$1,000	$651
Nonuser benefits (½ of total recreational use)	$500	$326
Total Recreational Benefits (2001$)	**$1,500**	**$977**

Source: U.S. EPA analysis.

The recreational trips corresponding to the three activities considered in this analysis are stochastically independent; EPA calculated the total value of enhanced water-based recreation opportunities by summing the three recreation categories and nonuser value. The resulting increase in the value of water resources to consumers of water-based recreation and nonusers is $1,500 thousand (2001$) annually under the traditional extrapolation method and $977 thousand (2001$) annually under the post-stratification extrapolation method.

ES.4.3 POTW Impacts

The final rule only regulates direct dischargers. Therefore, the selected option does not affect POTW operation. For the alternative policy options that consider both direct and indirect dischargers, EPA evaluated two productivity measures associated with MP&M pollutants. The first measure is the reduction in pollutant interference at publicly-owned treatment works (POTWs). The second measure is pass-through of pollutants into the sludge, which limits options for POTW disposal of sewage sludge. These analyses are presented in Chapter 16 of this report.

ES.4.4 Total Estimated Benefits of the Final MP&M Rule

Using the traditional extrapolation method, EPA estimates total benefits for the five monetized categories of approximately $1,500,000 (2001$) annually. This value understates the total benefits of the rule because the benefits analysis omits significant sources of benefits to society. Examples of benefit categories not reflected in this estimate include non-cancer health benefits other than benefits from reduced exposure to lead; other water-dependent recreational benefits, such as swimming and waterskiing benefits to recreational users from reduced concentration of conventional pollutants and nonconventional pollutants such as TKN; and reduced cost of drinking water treatment for the pollutants with drinking water criteria. In addition, as noted in the prior discussion, although the national-level benefits analysis finds negligible benefits from reduced health risk, the more rigorous analytic approach used for the Ohio case study found material health-related benefits approximately $0.5 million in the state of Ohio alone.

ES.5 National Benefits-Costs Comparison

The comparison of benefits and for the final rule is inevitably incomplete because EPA cannot value all of the benefits resulting from the final rule in dollar terms. A comparison of benefits and costs is thus limited by the lack of a comprehensive benefits valuation and also by uncertainties in the estimates. Bearing these limitations in mind, EPA presents a summary comparison of benefits and costs for the final rule in Table ES.10. The estimated social cost of the final rule is $13.8 million annually (2001$). The total benefits that can be valued in dollar terms in the categories traditionally analyzed for effluent guidelines range from $977,000 to $1,500,000 annually (2001$), based on the alternative extrapolation methods.

As previously noted, EPA used more detailed information and a more comprehensive analytic method to estimate expected benefits of the final rule for the state of Ohio. This more rigorous analysis was undertaken to address certain issues in the national-level analysis and to supplement the national-level analysis performed for the final rule. The following section presents this analysis. The Ohio case study showed that the more rigorous analytic approach leads to a different conclusion from that found in the simpler, national-level analysis approach in particular, that the estimated state-level benefits exceed the estimated state-level cost. As previously discussed, given (1) that Ohio accounts for only about 6 percent of total MP&M facilities, and (2) that other states with substantial numbers of MP&M facilities have similar population and water body characteristics to Ohio, EPA estimates that use of the more rigorous approach nationally would yield a higher estimate of national benefits. On this basis, the Agency estimates that national benefits from the final rule may be comparable to its social costs.

Table ES.10: Comparison of National Annual Monetizable Benefits to Social Costs (thousands, 2001$)

Benefit and Cost Categories	Traditional Extrapolation	Post-Stratification Extrapolation
Benefit Categories		
Reduced Cancer Risk from Fish Consumption	$0	$0
Reduced Cancer Risk from Water Consumption	$0	$0
Reduced Risk from Exposure to Lead	$0	$0
Enhanced Water-Based Recreation	$1,000	$651
Nonuse Benefits	$500	$326
Total Monetized Benefits	**$1,500**	**$977**
Cost Categories		
Resource Costs of Compliance	$13,825	$13,825
Costs of Administering the Final Regulation	$0	$0
Social Costs of Unemployment	$0	$0
Total Monetized Costs	**$13,825**	**$13,825**
Net Monetized Benefits (Benefits Minus Costs)	**($12,325)**	**($12,847)**

Source: U.S. EPA analysis.

ES.6 OHIO CASE STUDY

Part V of this report presents a detailed case study of the expected state-level costs and benefits of the MP&M rule in Ohio. The case study assesses the costs and benefits of the final rule for facilities and water bodies located in Ohio. Ohio is among the ten states with the largest numbers of MP&M facilities. The state has a diverse water resource base and a more extensive water quality ecological database than many other states. EPA gathered data on MP&M facilities and on Ohio's baseline water quality conditions and water-based recreation activities to support the case study analysis. These data characterize current water quality conditions, water quality changes expected from the regulation, and the expected welfare changes from water quality improvements at water bodies affected by MP&M discharges. The case study also estimates the social costs of the final rule for facilities in Ohio and compares estimated social costs and benefits for the state.

The case study analysis supplements the national-level analysis performed for the final MP&M regulation in two important ways. First, the analysis used improved data and methods to determine MP&M pollutant discharges from both MP&M facilities and other sources. In particular, EPA administered 1,600 screener questionnaires to augment information on the Ohio's MP&M facilities. The Agency also used information from the sampled MP&M facilities to estimate discharge characteristics of non-sampled MP&M facilities, as described in Appendix H of the EEBA report. The Agency assigned discharge characteristics to all non-MP&M industrial direct discharges based on the information provided in the EPA's Permit Compliance System (PCS) database. Second, the analysis used an original travel cost study to value four recreational uses of water resources affected by the regulation: swimming, fishing, boating, and near-water activities. The added detail provides a more complete and reliable analysis of water quality changes from reduced MP&M discharges. The study provides more complete estimates of changes in human welfare resulting from reduced health risk, enhanced recreational opportunities, and improved economic productivity.

EPA estimated human health benefits from reduced MP&M dischargers in Ohio using similar methodologies to those used for the national-level analysis. These methodologies are presented in Chapter 13 and 14 of the EEBA report.

The case study analysis of recreational benefits combines water quality modeling with a random utility model (RUM) to assess how changes in water quality from the regulation will affect consumers' valuation of water resources. The RUM analysis addresses a wide range of pollutant types and effects, including water quality measures not often addressed in past recreational benefits studies. In particular, the model supports a more complete analysis of recreational benefits from reductions in nutrients and toxic pollutants (i.e., priority pollutants and nonconventional pollutants with toxic effects).

EPA subjected this study to a formal peer review by experts in the natural resource valuation field. The peer review concluded that EPA had done a competent job, especially given the available data. As requested by the Agency, peer reviewers provided suggestions for further improvements in the analysis. Since the proposed rule analysis, the Agency made changes to the Ohio model and conducted additional sensitivity analyses suggested by the reviewers. The peer review report and EPA's response to peer reviewers' comments, along with the revised model, are in the docket for the rule.

ES.6.1 Benefits

The use of an original RUM in this case study allows the Agency to address limitations inherent in benefits transfer used in the analysis of recreational benefits at the national level. The use of benefits transfer often requires additional assumptions because water quality changes evaluated in the available recreation demand studies are only roughly comparable with the water quality measures evaluated for a particular rule. The RUM model estimates the effects of the specific water quality characteristics analyzed for the final MP&M regulation, such as presence of AWQC exceedances and concentrations of the nonconventional pollutant Total Kjeldahl Nitrogen (TKN). EPA estimates that this direct link between the water quality characteristics analyzed for the rule and the characteristics valued in the RUM analysis reduces uncertainty in benefit estimates and makes the analysis of recreational benefits more robust.

The final MP&M regulation affects a broad range of pollutants, some of which are toxic to human and aquatic life but are not directly observable (i.e., priority and nonconventional pollutants). These unobservable toxic pollutants degrade aquatic habitats, decrease the size and abundance of fish and other aquatic species, increase fish deformities, and change watershed species composition. Changes in toxic pollutant concentrations may therefore affect recreationists' valuation of water resources, even if consumers are unaware of changes in ambient pollutant concentrations.

The study used data from the National Demand Survey for Water-Based Recreation (NDS), conducted by U.S. EPA and the

National Forest Service, to examine the effects of in-stream pollutant concentrations on consumers' decisions to visit a particular water body. The analysis estimated baseline and post-compliance water quality at recreation sites actually visited by the surveyed consumers and at all other sites within the consumers' choice set, visited or not. The RUM analysis of consumer behavior then estimated the effect of ambient water quality and other site characteristics on the total number of trips taken for different water-based recreation activities and the allocation of these trips among particular recreational sites. The RUM analysis is a travel cost model, in which the cost to travel to a particular recreational site represents the "price" of a visit.

EPA modeled two consumer decisions: (1) how many water-based recreational trips to take during the recreational season (the trip participation model); and (2) which recreation site to choose (the site choice model). Combining the trip participation model's prediction of trips under the baseline and post-compliance scenarios and the site choice model's per-trip welfare measure provides a measure of total welfare. EPA calculated each individual's seasonal welfare gain for each recreation activity from post-compliance water quality changes, and then used Census data to aggregate the estimated welfare change to the State level. The sum of estimated welfare changes over the four recreation activities yielded estimates of total welfare gain.

EPA estimated other components of benefits in Ohio using similar methodologies to those used for the national-level analysis. In addition to the RUM study of recreational benefits, other analytical improvements included the following: (1) use of more detailed data on MP&M facilities, obtained from the 1,600 additional surveys; (2) use of data on non-MP&M discharges to estimate current baseline conditions in the state, and (3) use of a first-order decay model to estimate in-stream concentrations in the Ohio water bodies in the baseline and post-compliance.

Appendix H of this report describes the water quality model used in this analysis and the approach and data sources used to estimate total pollutant loadings from all industrial and municipal sources to Ohio's water bodies. The Agency has concluded that the added level of detail results in more robust benefit estimates.

Summing the monetary values over all benefit categories yields total monetized benefits of $930,408 (2001$) annually for the final rule, as shown in Table ES.11. Although more comprehensive than the national benefits analysis, the case study benefit estimates still omit important mechanisms by which society is likely to benefit from the final rule. Examples of benefit categories not reflected in the monetized benefits include non-cancer health benefits (other than lead-related benefits) and reduced costs of drinking water treatment.

Table ES.11: Annual Benefits from Reduced MP&M Discharges in Ohio (thousands, 2001$)

Benefit Category	Mean Annual Benefits
1. Reduced cancer risk:	
Fish consumption	$15
Water consumption	$0
2. Reduced risk from exposure to lead:	
Children	$422
Adults	$117
3. Enhanced fishing	$153
4. Enhanced swimming	$10
5. Enhanced boating	$0
4. Enhanced wildlife viewing	$88
5. Nonuse benefits (½ recreational use benefits)	$125
Total Monetized Benefits	**$930**

Source: U.S. EPA analysis.

ES.6.2 Social Costs

EPA also estimated the social costs of the final rule for MP&M facilities in Ohio. EPA developed engineering estimates of compliance costs for each Ohio facility, and annualized costs using a seven percent discount rate over a 15-year period.

Estimating the frequency of baseline closures is necessary to assess the costs of regulation. Facilities assessed as baseline closures are not expected to incur compliance costs under the final MP&M regulation. The screener data collected for Ohio facilities did not provide financial data to perform an after-tax cash flow or net present value test, as done in the national analysis. EPA therefore used data from the national analysis to estimate the percentage of facilities assessed as baseline closures. EPA assumed that the frequency of baseline closures among Ohio facilities would be the same as that estimated in the national analysis for facilities with the same discharge status, subcategory, and flow category. For example, two percent of direct Oily Wastes facilities discharging less than one million gallons per year close in the baseline in the national data set; this same percentage is assumed for Ohio screener indirect dischargers in that flow and size category. EPA reduced the total estimated costs for screener facilities, by analysis category, based on the fraction of facilities assessed as baseline closures.

EPA used the same methods as used in the national social cost analysis to estimate other components of social costs for the Ohio case study. Table ES.12 shows the total estimated social costs of the final rule for Ohio facilities.

Table ES.12: Annual Social Costs for Ohio Facilities: Final Option (thousands, 2001$, costs annualized at 7%)

Component of Social Costs	Final Rule
Resource value of compliance costs	$62
Government administrative costs	$0
Social cost of unemployment	$0
Total Social Cost	$62

Source: U.S. EPA analysis.

ES.6.3 Comparing Monetized Benefits and Costs

The Ohio case study shows substantial net positive benefits associated with the MP&M regulation. EPA estimates the social cost in Ohio of the final regulation to be $62 thousand annually ($2001). The sum total of benefits that can be valued in dollar terms is $930 thousand annually ($2001). Comparing the midpoint estimate of social costs ($62 thousand) with the midpoint estimate of monetizable benefits ($930 thousand) results in a net social benefit of $868 thousand. This represents a partial cost-benefit comparison because not all of the benefits resulting from the regulation can be valued in dollar terms (e.g., changes in systemic health risk).

For the reasons previously discussed, EPA judges that the analytic approach and detailed data used for the Ohio case study provide a more robust and accurate benefits estimate than the data and approach used for the national-level analysis.

Chapter 1: Introduction

INTRODUCTION

CHAPTER CONTENTS

The U.S. Environmental Protection Agency (EPA) is promulgating effluent limitations guidelines and standards for the Metal Products and Machinery (MP&M) Point Source Category, under Sections 301, 304, 306, 307 and 501 of the Clean Water Act. EPA has determined that the final rule is not likely to result in aggregate costs to the economy that exceed $100 million annually. The Agency therefore found that the final regulation is not a "significant regulatory action" as defined by Executive Order 12866 (58 FR 51735, October 4, 1993).

1.1 PURPOSE

This Economic, Environmental, and Benefits Analysis report (EEBA) presents EPA's economic and benefits analyses for the final MP&M regulation. These analyses supported EPA in developing the final regulation and in meeting the requirements of the following statutes and executive orders:

- Executive Order 12866 "Regulatory Planning and Review", which requires analysis of costs, benefits, and economic impacts of the final rule and regulatory alternatives;
- Unfunded Mandates Reform Act (UMRA), which requires evaluation of impacts on governments, among other requirements;
- Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (RFA/SBREFA), which requires consideration of the rule's impact on small firms and governments;
- Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations"; and
- Executive Order 13084 " Protection of Children from Environmental Health Risks and Safety Risks".

1.2 ORGANIZATION

This report is organized in five major parts, 22 chapters, and 14 appendices, as follows:

Part I "Introduction and Background Information" (Chapters 1 though 4) describes the need for the regulation, provides a profile of the MP&M industry, and describes regulatory options evaluated and selected by the Agency for the final rule.

Part II "Costs and Economic Impacts" (Chapters 5 through 11) presents EPA's analysis of the economic impacts and social costs of the final rule. Chapter 5 presents the analysis of costs and impacts at the facility level. Chapters 6 through 9 present analyses of other types of economic impacts that derive from the facility-level analysis, including impacts on employment, governments (for EPA's analyses under UMRA), communities, foreign trade, firms, and new facilities. Chapter 10 provides an analysis of impacts on small firms and governments, as required by RFA/SBREFA. Finally, Chapter 11 presents the social costs of the final rule.

Part III "Benefits" (Chapters 12 through 17) provides EPA's analysis of the environmental impacts and benefits of the final rule. Chapter 12 provides an overview of the benefits expected from the rule. Chapters 13 through 16 present EPA's analyses of different components of the benefits analysis. These include human health benefits (except for lead-related) (Chapter 13), lead-related benefits (Chapter 14), recreational benefits (Chapter 15), and benefits to POTWs (Chapter 16). Chapter 17 presents an analysis of the environmental justice effects of the final rule, as required by Executive Order 12898.

Part IV "Comparison of Costs and Benefits" (Chapters 18 and 19) compares the social costs and benefits for the final rule (Chapter 18) and for other regulatory alternatives evaluated by the Agency for the final rule (Chapter 19).

Part V " Ohio Case Study" (Chapters 20 through 22) provides a detailed case study of the final rule's costs and benefits for the State of Ohio. This case study includes a more detailed and complete analysis of benefits, based on more complete information on the number and location of MP&M facilities and the characteristics of affected waters than was available for the national analyses. The case study also includes an original travel cost study to value recreational uses affected by the final rule. EPA believes that the case study provides more robust results because it avoids the uncertainties that result from the need to extrapolate sample facility results to the national level. The results of the case study generally confirm the overall results of the national analysis.

Appendices to this report provide additional material in support of the analyses described in the chapters, including the following:

- Appendix A: supporting material for the profile of the MP&M industries in Chapter 3;
- Appendix B: description of the cost pass-through analysis;
- Appendix C: description of the moderate impact analysis;
- Appendix D: description of the methodology used to estimate capital outlays as part of the facility impact analysis;
- Appendix E: description of the calculation of capital cost components;
- Appendix F: description of the methodology used to estimate POTW administrative costs;
- Appendix G: summary of the method used to extrapolate sample facility results to the national level;
- Appendix H: description of fate and transport model for drinking water and Ohio analyses;
- Appendix I: discussion of methodologies and results of the environmental assessment analysis;
- Appendix J: analyses of spatial distribution of MP&M facility location and benefiting population;
- Appendix K: description of the surface water valuation studies and specific values selected for assessing recreational benefits from the final regulation;
- Appendix L: description of parameters in the IEUBK lead model;
- Appendix M: sensitivity analysis of lead related benefits; and
- Appendix N: analysis of the national demand for water-based recreation survey (NDS).

The docket for the final rule, located at U.S. EPA Headquarters, provides additional supporting documentation, including:

- copies of the literature cited in the report;
- documentation of the financial and economic portions of the MP&M Section 308 surveys;
- memorandums documenting supplementary analyses undertaken in support of regulation development, but that are not included in the EEBA; and
- datasets, spreadsheets, and programs used to perform the analyses.

1.3 READERS' AIDS

Each chapter includes a chapter-specific table of contents. A list of references is provided at the end of each chapter. Glossaries and lists of acronyms are also provided at the end of the chapters, and the first usage of items listed in them are denoted in the text with the following formats:

- ***Glossary*** indicates that a term is defined in the chapter glossary, and
- **Acronym** indicates that the acronym is included in the chapter list of acronyms.

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Chapter 2: The MP&M Industry and the Need for Regulation

INTRODUCTION

The Metal Products and Machinery (MP&M) effluent guidelines establish limitations and standards only for direct dischargers in the Oily Wastes subcategory (40 CFR 438, Subpart A). EPA establishes industrial subcategories based on a number of considerations (see Chapter 4 and Section 6 of the TDD). EPA evaluated seven other subcategories for the final rule: general metals, metal finishing job shops, non chromium anodizing, printed wiring board, railroad line maintenance, shipbuilding dry docks, and steel forming and finishing. EPA evaluated a number of options for these seven subcategories. Based on these analyses, EPA did not establish or revise limitations or standards for facilities in these seven subcategories.

CHAPTER CONTENTS

The facilities regulated under this rule produce, manufacture, rebuild, or maintain metal parts, products, or machines for use in sixteen different industrial sectors. These industrial sectors include: hardware, aircraft, aerospace, ordnance, electronic equipment, stationary industrial equipment, mobile industrial equipment, buses and trucks, motor vehicles, household equipment, instruments, office machines, railroads, ships and boats, precious metals and jewelry, and miscellaneous metal products. Most of the subcategories above serve multiple markets. EPA evaluated options that would have covered facilities in three additional industrial sectors: printed wiring boards, metal finishing job shops, and iron and steel. The final regulation does not cover facilities in these sectors.

This chapter provides an overview of the ***MP&M industry*** evaluated for the final rule and presents the pollutant discharges from ***MP&M facilities*** subject to the final regulation. The chapter also reviews the reasons why EPA is regulating the industry's effluent discharges including the need to reduce pollutant discharges from the MP&M industry, the issue of addressing market imperfections, other effluent guidelines that may overlap in coverage of the MP&M industry sectors evaluated for the final rule, and requirements that stem from the ***Clean Water Act*** (CWA) and litigation.

2.1 OVERVIEW OF FACILITIES EVALUATED FOR REGULATION UNDER THE MP&M POINT SOURCE CATEGORY

The MP&M Point Source Category regulates oily operations process wastewater discharges to surface waters from existing or new industrial facilities (including facilities owned and operated by Federal, State, or local governments) engaged in manufacturing, rebuilding, or maintenance of metal parts, products, or machines for use in the sixteen Metal Product & Machinery (MP&M) industrial sectors listed above. Please note the underlined language in the previous sentence as a facility may be subject to the MP&M effluent guidelines even if it is not in one of the MP&M industry sectors. For example, EPA considers a facility performing machining part of the "Bus & Truck" MP&M industry sector if it manufactures metal parts for truck trailers. Process wastewater means wastewater as defined at 40 CFR parts 122 and 401, and includes wastewater from air pollution control devices (see 40 CFR 438.2(g)). Oily operations are listed at 40 CFR 438.2(g) and defined in Appendix B to Part 438 (see also Section 4 of the TDD).

As defined for this document, MP&M facilities: (1) produce metal parts, products, or machines for use in one of the 19 industry sectors evaluated for coverage in the MP&M point source category; (2) use operations in one of the eight regulatory subcategories evaluated for coverage in the MP&M point source category; and (3) discharge process wastewater, either directly or indirectly, to surface waters. MP&M facilities frequently produce products for multiple sectors and subcategories. As referred to in this document, MP&M facilities represent only a portion of all facilities in the industry sectors, since some facilities may perform operations that are not covered by one of the subcategories (i.e., part assembly or plastic molding), and some may not generate or discharge process wastewater.

According to *Statistics of U.S. Business*, 1996, approximately 638,696 establishments operate in the MP&M industry sectors. Based on information in the MP&M survey database, approximately 44,000 facilities meet the definition of an MP&M facility. These 44,000 facilities include approximately 41,000 indirect dischargers (i.e., facilities discharging effluent to a ***publicly-owned sewage treatment works*** or **POTW**s) that would be subject to ***Pretreatment Standards for Existing Sources* (PSES)**. The remaining 3,000 direct dischargers (i.e., they discharge effluent directly to a waterway under a National Pollutant Discharge Elimination System **(NPDES)** permit) and would thus be subject to ***Best Available Technology Economically Achievable* (BAT)** and ***Best Practicable Control Technology Currently Available* (BPT)** requirements.

Table 2.1 reports the estimated number of MP&M facilities and total discharge flow (before final rule implementation) by type of facility. The largest number of sites, approximately 22,000, perform "rebuilding/maintenance only" and account for approximately 6 percent of the total estimated discharge flow for the industry. "Manufacturing only" contains the next largest number of facilities (15,400) and accounts, by far, for the largest percentage of the total estimated discharge flow for the industry (82 percent).

Table 2.1: Number of MP&M Facilities and Total Discharge Flow by Type of Facility

Type of Facility	Number of Facilities	Total Estimated Discharge Flow (million gal/yr)	Percent of Facilities	Percent of Total Discharge Flow
Manufacturing & Rebuilding/Maintenance	6,600	9,400	15.0%	12.0%
Manufacturing Only	15,400	64,100	35.0%	82.0%
Rebuilding/Maintenance Only	22,000	4,700	50.0%	6.0%
Total	44,000	78,200	100.0%	100.0%

Source: U.S. EPA analysis. See Section 4 of the Technical Development Document for the final rule.

Of the 43,858 water discharging facilities, 3,593 are predicted to close in the baseline, leaving 40,265 existing MP&M facilities that EPA estimates could be regulated.[1] After accounting for subcategory and discharger class exclusions, EPA estimates that the final rule will regulate 2,382 of these facilities, all of which are direct dischargers. These regulated facilities represent 5.9 percent of the 40,265 facilities that could be potentially regulated.

Table 2.2 summarizes information on the total number of MP&M facilities that were evaluated for the final rule, and the number that will be regulated under the final rule. As reported in Table 2.2, no indirect dischargers are subject to the final regulation. The rule will regulate 2,382 direct dischargers in the Oily Wastes subcategory. The rule excludes direct dischargers in the General Metals, Metal Finishing Job Shops, Non -Chromium Anodizing, Printed Wiring Board, Railroad Line Maintenance, Shipbuilding Dry Docks, and Steel Forming and Finishing subcategories (214 facilities, 12 facilities, 0 facilities, 8 facilities, 6 facilities, 6 facilities, and 13 facilities, respectively)[2].

[1] These are facilities that are predicted to close due to weak financial performance under baseline conditions, i.e., in the absence of the final rule. EPA does not attribute the costs or the reduced discharges resulting from these baseline closures to the final rule, and therefore excludes these facilities from its analyses of the rule's impacts. Baseline closures account for differences between the universe of facilities discussed in this report and the universe discussed in the *Technical Development Document.*

[2] EPA excluded 3,511 indirect and 98 direct dischargers predicted to close in the baseline.

Table 2.2: MP&M Facilities by Subcategory and Discharger Class, and Facilities Regulated Under the Final Rule[a]

Subcategory	Indirect Dischargers: Evaluated for Regulation (# of facilities)	Indirect Dischargers: Regulated under Final Rule (# of facilities)	Direct Dischargers: Evaluated for Regulation (# of facilities)	Direct Dischargers: Regulated under Final Rule (# of facilities)
General Metals	10,244	0	214	0
Metal Finishing Job Shop	1,479	0	12	0
Non-Chromium Anodizing	93	0	0	0
Printed Wiring Board	600	0	8	0
Steel Forming & Finishing	12	0	13	0
Oily Waste	24,394	0	2,382	2,382
Railroad Line Maintenance	820	0	6	0
Shipbuilding Dry Dock	9	0	6	0
All Categories	37,652	0	2,641	2,382

[a] Excludes facilities that close in the baseline.

Source: U.S. EPA analysis.

2.2 MP&M DISCHARGES AND THE NEED FOR REGULATION

EPA is regulating the MP&M industry because the industry releases substantial quantities of pollutants, including toxic pollutant compounds (priority and nonconventional metals and organics) and ***conventional pollutants*** such as ***total suspended solids*** (TSS) and ***oil and grease*** (O&G). These MP&M industry pollutants are generally controlled by straightforward and widely-used treatment system technologies such as chemical precipitation and clarification (frequently referred to as the "lime and settle" process).[3]

Discharges of these pollutants to surface waters and POTWs have a number of adverse effects, including degradation of aquatic habitats, reduced survivability and diversity of native aquatic life, and increased human health risk through the consumption of contaminated fish and water. In addition, many of these pollutants volatilize into the air, disrupt biological wastewater treatment systems, and contaminate sewage sludge.

Metal constituents are of particular concern because of the large amounts present in MP&M effluents. Unlike some organic compounds and other wastes that are metabolized in activated sludge systems to relatively innocuous constituents, metals are chemical elements and cannot be eliminated. Moreover, in solution, some metals have a high affinity for biological uptake. Depending on site-specific conditions, metals form insoluble inorganic and organic complexes that partition to sewage sludge at POTWs or underlying sediment in aquatic ecosystems. The accumulated metal constituents can return to a ***bioavailable*** form upon land application of sewage sludge; dredging and resuspension of sediment; or as a result of seasonal, natural, or induced alteration of sediment chemistry.

Benefits of reducing metal and other pollutant loads to the environment from MP&M facilities include reduced risk of cancer and systemic human health risks, improved recreation opportunities (e.g., fishing , swimming, boating, and other near-water recreational activities), improved aquatic and benthic habitats, and less costly sewage sludge disposal and increased beneficial use of the sludge.[4]

[3] See Chapter 12 and Appendix I for more detailed information on the pollutants of concern in the MP&M industry.

[4] Sewage sludge is also called biosolids.

The goal of the MP&M regulation is to reduce pollutant discharges and to eliminate or reduce the level of risk and harm caused by them. These pollutant discharges and their harmful consequences are the ***externalities*** that the MP&M regulation addresses, as discussed in Section 2.3.

2.2.1 Baseline MP&M Discharges for Regulated Facilities

Table 2.3 provides an overview of the discharges from MP&M facilities that are regulated under the final rule. Loadings are defined as ***toxic-weighted*** loadings. This measure weights quantities of different pollutants by a measure of their relative toxicity. Toxic-weighted loadings measures the relative toxic effects of discharges containing different mixtures of pollutants. MP&M discharges also contain conventional pollutants with little or no toxic effects but that can have substantial adverse environmental impacts, such as O&G and some components of TSS.

Table 2.3: Toxic-Weighted Discharges for Direct Discharging Facilities in the Oily Wastes Subcategory (Pounds Equivalent)[a]

# of Regulated Facilities	2,382
Baseline Discharges	3,351
Average Baseline Loadings per Facility	1.41
Remaining Discharges Under Final Rule	668
Average Discharges Under Final Rule per Facility	0.28
Discharge Reductions Achieved by Final Rule	2,683

[a] Discharges discussed in this table are total discharges from the facility, and do not reflect POTW pollutant removals. EPA believes it is appropriate to analyze wastewater discharges disregarding POTW removals because indirect discharges present environmental risks that are not fully addressed by POTW treatment. The MP&M industry releases 89 pollutants that cause inhibition problems at POTWs and an additional 35 pollutants that volatilize to form hazardous air pollutants (HAPs) that may present a threat to human health or the environment. Other MP&M pollutants are found in POTW sludge. Only eight of these pollutants have land application pollutant criteria that limit the uses of sludge.

[b] Excludes discharges from facilities that are projected to close in the baseline (327 lbs-equiv., or an average of 4.4 lbs-equiv. per closing facility).

Source: U.S. EPA analysis.

As reported in Table 2.3, direct dischargers in the Oily Wastes subcategory currently release a total of 3,351 toxic weighted pounds per year, an average of 1.41 toxic weighted pounds per facility. After implementation of the final rule, EPA estimates that Oily Wastes direct dischargers will release only 668 toxic weighted pounds per year, an average of 0.28 toxic pounds per facility. EPA estimates that the final rule will reduce pollutant discharges by approximately 2,683 toxic weighted pounds per year.

2.2.2 Discharges under the MP&M Regulation

Reductions in toxic loadings result from treatment of effluents and pollution prevention at facilities that are subject to the regulation. Table 2.4 shows baseline and post-regulation loadings by type of pollutant, both as unweighted pounds and on a toxic-weighted basis, for facilities that are regulated under the final rule. The final rule eliminates 80.1 percent of the baseline toxic-weighted loadings from the facilities that are regulated, including 83.7 percent of the ***priority pollutants*** (87.3 percent of metals, 22.4 percent of organics, and 1.3 percent of arsenic) and 57.4 percent of the ***nonconventional pollutants*** (62.1 percent of metals, 13.3 percent of organics, and 50.0 percent of "other inorganics"). The final rule also eliminates substantial fractions of the baseline discharges of conventional pollutants from the regulated facilities, including 6.6 percent of

***chemical oxygen demand* (COD)**, 37.1 percent of ***biological oxygen demand* (BOD)**, 93.2 percent of oil and grease (O&G), and 54.1 percent of total suspended solids (TSS).[5]

Table 2.4: Summary of Discharges by Pollutant Type for Facilities Regulated under the Final Rule[a]

Pollutant Category	Current Releases		Releases under the Final Rule		Final Rule Reductions	
	Pounds	Pounds Eq.	Pounds	Pounds Eq.	Pounds	Pounds Eq.
Priority Pollutants						
Metals	794	2,756	153	351	641	2,405
Organics	336	58	268	45	68	13
Arsenic	22	75	21	74	1	1
Cyanide (CN)	0	0	0	0	0	0
Nonconventional Pollutants						
Metals	25,863	417	16,428	158	9,435	259
Organics	2,159	45	1,038	39	1,121	6
Other Inorganics	2,334	0.2	1,301	0.1	1,033	0.1
Bulk Pollutants	335,679		167,295		168,384	
Conventional Pollutants						
BOD	263,419		165,567		97,852	
COD	523,440		488,697		34,743	
O&G	428,137		28,955		399,182	
TSS	160,695		73,769		86,926	

[a] Discharges discussed in this table are facility discharges and do not account for POTW removals. EPA believes it is appropriate to analyze wastewater discharges disregarding POTW removals because indirect discharges present environmental risks that are not fully addressed by POTW treatment. The MP&M industry releases 89 pollutants that cause inhibition problems at POTWs and an additional 35 pollutants that volatilize to form hazardous air pollutants (HAPs) that may present a threat to human health or the environment. Other MP&M pollutants released by the industry are found in POTW sludge. Only eight of these pollutants have land application pollutant criteria that limit the uses of sludge.

Source: U.S. EPA analysis.

2.3 Addressing Market Imperfections

Environmental legislation in general, and the CWA and the MP&M regulation in particular, seek to correct imperfections – ***uncompensated*** environmental externalities – in the functioning of the market economy. In manufacturing, rebuilding, and repairing metal products and machinery, MP&M facilities release pollutants that increase risks to human health and aquatic life and cause other environmental harm without accounting for the consequences of these actions on other parties (sometimes referred to as ***third parties***) who do not directly participate in the business transactions of the business entities.

[5] It is not possible to provide an overall estimate of total pollutant pounds removed, because overlap among some of the pollutant categories would result in double-counting if the categories were summed. For example, TSS may include some of the priority pollutant and nonconventional metals discharges. Use of the toxic-weighted loadings avoids this double-counting, but does not include conventional pollutants.

These costs are not borne by the responsible entities and are therefore *external* to the production and pricing decisions of the responsible entity.

A profit-maximizing firm or a cost-minimizing government-owned facility will ignore these costs when deciding how much to produce and how to produce it. In addition, the externality is uncompensated because no party is compensated for the adverse consequences of the pollution releases.

When these external costs are not accounted for in the production and pricing decisions of the responsible entities, their decisions will yield a mix and quantity of goods and services in the economy, and an allocation of economic resources to production activities, that are less than optimal. In particular, the quantity of pollution and related environmental harm caused by the activities of the responsible entities will, in general, exceed ***socially optimal levels***. As a result, society will not maximize total ***social welfare***.

In addition, adverse ***distributional effects*** may accompany the uncompensated environmental externalities. If the distribution of pollution and environmental harm is not random among the U.S. population, but instead is concentrated among certain population subgroups based on socio-economic or other demographic characteristics, then the uncompensated environmental externalities may produce undesirable transfers of economic welfare among subgroups of the population. See *Chapter 17: Environmental Justice and Protection of Children* for more information.

The goal of environmental legislation and implementing regulations, including the final MP&M rule that is the subject of this EEBA, is to correct these environmental externalities by requiring businesses and other polluting entities to reduce their pollution and environmental harm. Congress, in enacting the authorizing legislation, and EPA, in promulgating the implementing regulations, act on behalf of society to achieve a mix of goods and services and a level of pollution that more nearly approximates socially optimal levels. As a result, the mix and quantity of goods and services provided by the economy, the allocation of economic resources to those activities, and *the quantity of pollution and environmental harm accompanying those activities* will yield higher economic welfare to society.

Requiring polluting entities to reduce levels of pollution and environmental harm is one approach to addressing the problem of environmental externalities. This approach imposes costs on the polluting entities in the form of compliance costs incurred to reduce pollution to allowed levels. A polluting entity will either incur the costs of meeting the regulatory limits or will determine that compliance is not in its best financial interest and will cease the pollution-generating activities. This approach to addressing the problem of environmental externalities will generally result in improved economic efficiency and net welfare gains for society if the cost of reducing the pollution and environmental harm activities is less than the value of benefits to society from the reduced pollution and environmental harm.

It is theoretically possible to correct the market imperfection by means other than direct regulation. For example, negotiation and/or litigation could achieve an optimal allocation of economic resources and mix of production activities within the economy. However, the transaction costs of assembling the affected parties and involving them in the negotiation/litigation process, as well as the public goods character of the improvement sought by negotiation or litigation, make this approach impractical.

2.4 Overlap with Other Effluent Guidelines

EPA has previously promulgated effluent guidelines regulations for 13 metals-related industries. In some instances, these industries may perform operations that are found in MP&M facilities. These effluent guidelines are:

- Electroplating (40 CFR Part 413),
- Iron & Steel Manufacturing (40 CFR Part 420),
- Nonferrous Metals Manufacturing (40 CFR Part 421),
- Ferroalloy Manufacturing (40 CFR Part 424),
- Metal Finishing (40 CFR Part 433),
- Battery Manufacturing (40 CFR Part 461),

- Metal Molding & Casting (40 CFR Part 464),
- Coil Coating (40 CFR Part 465),
- Porcelain Enameling (40 CFR Part 466),
- Aluminum Forming (40 CFR Part 467),
- Copper Forming (40 CFR Part 468),
- Electrical & Electronic Components (40 CFR Part 469), and
- Nonferrous Metals Forming & Metal Powders (40 CFR Part 471).

In 1986, the Agency reviewed coverage of these regulations and identified a significant number of metals processing facilities discharging wastewater that these 13 regulations did not cover. From this review, EPA performed a more detailed analysis of these unregulated sites and identified the discharge of significant amounts of pollutants. This analysis resulted in the formation of the "Machinery Manufacturing and Rebuilding" **(MM&R)** point source category. In 1992, EPA changed the name of the category to "Metal Products and Machinery" **(MP&M)** to clarify coverage of the category (57 FR 19748).

Only direct dischargers in the Oily Wastes subcategory will be regulated under the final regulations for 40 CFR Part 38. Table 2.5 shows the MP&M subcategories and the coverages that apply to each. EPA does not intend this table to be exhaustive, but rather to provide a general overview of the applicability of the Electroplating, Metal Finishing, and Metal Products & Machinery effluent guidelines.

Table 2.5: Coverage by MP&M Subcategory

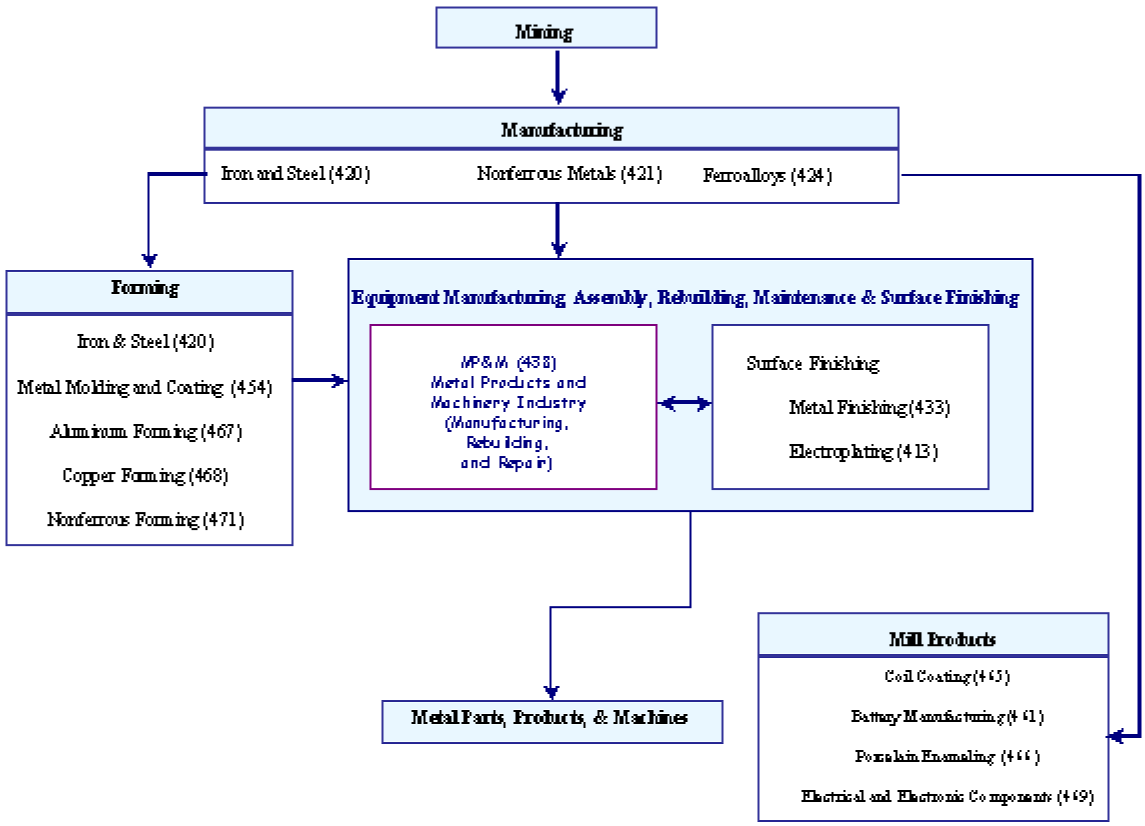
Subcategory	Continue Coverage under 40 CFR Part 413 (Electroplating)	Continue Coverage under 40 CFR Part 433 (Metal Finishing)	Coverage under 40 CFR Part 438 (Metal Products & Machinery)
General Metals (including Continuous Electroplaters)	Existing indirect dischargers currently covered by Part 413.	New and existing direct and indirect dischargers currently covered by Part 433.	None
Metal Finishing Job Shops	Existing indirect dischargers currently covered by Part 413.	New and existing direct and indirect dischargers currently covered by Part 433.	None
Non-Chromium Anodizers[a]	Existing indirect dischargers that are currently covered by 413.	New and existing direct and indirect dischargers currently covered by Part 433.	None
Printed Wiring Board (Printed Circuit Board)	Existing indirect dischargers that are currently covered by 413.	New and existing direct and indirect dischargers currently covered by Part 433.	None
Steel Forming & Finishing Wire Drawing[a]	N/A	N/A	None
Oily Waste[b]	N/A	N/A	All new and existing direct dischargers under this subcategory. (See 438.20)
Railroad Line Maintenance[b]	N/A	N/A	None
Shipbuilding Dry Docks[b]	N/A	N/A	None

[a] These facilities will continue to be subject to Part 420.
[b] There are no national categorical pretreatment standards for these facilities.

Source: U.S. EPA analysis.

Figure 2.1 illustrates the relationship among the various metals industries effluent guidelines.

Figure 2.1: Metals Industries Effluent Guidelines Covered Under 40CFR



Source: U.S. EPA analysis.

2.5 MEETING LEGISLATIVE AND LITIGATION-BASED REQUIREMENTS

EPA's effluent limitations guidelines and standards for the MP&M industry are under authority of the CWA, Sections 301, 304, 306, 307, and 501. These CWA sections require the EPA Administrator to publish limitations and guidelines for controlling industrial effluent discharges consistent with the overall CWA objective to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." EPA's MP&M industry regulation responds to these requirements.

In addition, the MP&M regulation responds to the requirements of a consent decree entered by the Agency as a result of litigation. Section 304(m) of the CWA (33 U.S.C. 1314(m)), added by the Water Quality Act of 1987, required EPA to establish schedules for (i) reviewing and revising existing effluent limitations guidelines and standards, and (ii) promulgating new effluent guidelines. On January 2, 1990, EPA published an Effluent Guidelines Plan (55 FR 80), in which schedules were established for developing new and revised effluent guidelines for several industry categories. One of the industries for which the Agency established a schedule was the Machinery Manufacturing and Rebuilding Category (MM&R).[6]

[6] The name was changed to Metal Products and Machinery (MP&M) in 1992 to avoid confusion over what was covered by the rule.

The Natural Resources Defense Council, Inc. **(NRDC)** and Public Citizen, Inc. challenged the Effluent Guidelines Plan in a suit filed in U.S. District Court for the District of Columbia (NRDC et al v. Reilly, Civ. No. 89-2980). The plaintiffs charged that EPA's plan did not meet the requirements of Section 304(m). A Consent Decree in this litigation was entered by the Court on January 31, 1992. This plan required, among other things, that EPA propose effluent guidelines for the MP&M category by November, 1994 and take final action on these effluent guidelines by May, 1996. EPA filed a motion with the Court on September 28, 1994, requesting an extension until March 31, 1995, for the EPA Administrator to sign the proposed regulation and a subsequent four month extension for signature of the final regulation in September 1996. EPA published a proposal entitled, "Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards: Metal Products and Machinery" (60 FR 28210) on May 30, 1995.

EPA initially divided the industry into two phases based on industry sector, as the Agency believed that would make the regulation more manageable. The Phase I proposal included the following industry sectors: Aerospace; Aircraft; Electronic Equipment; Hardware; Mobile Industrial Equipment; Ordnance; and Stationary Industrial Equipment. At that time, EPA planned to propose a rule for the Phase II sectors approximately three years after the MP&M Phase I proposal.

EPA received over 4,000 pages of public comment on the Phase I proposal. One area where commenters from all stakeholder groups (i.e., industry, environmental groups, and regulators) were in agreement was that EPA should not divide the MP&M industry into two separate regulations. Commenters raised concerns regarding the regulation of similar facilities with different compliance schedules and potentially different limitations for similar processes based solely on whether the facilities were in a Phase I or Phase II sector. Furthermore, a large number of facilities performed work in multiple sectors. In such cases, permit writers and control authorities (e.g., POTWs) would need to decide which MP&M rule (Phase I or 2) applied to a facility.

Based on these comments, EPA decided to combine the two phases of the regulation into one proposal. EPA published a proposal entitled, "Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards for the Metal Products and Machinery Point Source Category" (66 FR 424) on January 3, 2001. The proposal published in January 2001 completely replaced the 1995 proposal.

On June 5, 2002, EPA published a Notice of Data Availability (NODA) (67 FR 38752). In the NODA, EPA discussed major issues raised in comments on the 2001 proposal; suggested revisions to the technical and economic methodologies used to estimate compliance costs, pollutant loadings, and economic and environmental impacts; presented the results of these suggested methodology changes and incorporation of new (or revised) data; and summarized the Agency's thinking on how these results could affect the Agency's final decisions.

This report addresses the 304(m) decree as amended, requiring the MP&M rules to be promulgated by February 14, 2003.

GLOSSARY

Best Available Technology Economically Achievable: Effluent limitations for direct dischargers, addressing priority and nonconventional pollutants. BAT is based on the best existing economically achievable performance of plants in the industrial subcategory or category. Factors considered in assessing BAT include the cost of achieving BAT effluent reductions, the age of equipment and facilities involved, the processes employed, engineering aspects of the control technology, potential process changes, non-water quality environmental impacts (including energy requirements), economic achievability, and such factors as the Administrator deems appropriate. The Agency may base BAT limitations upon effluent reductions attainable through changes in a facility's processes and operations. Where existing performance is uniformly inadequate, EPA may base BAT upon technology transferred from a different subcategory within an industry or from another industrial category.

Best Practicable Control Technology Currently Available: Effluent limitations for direct discharging facilities, addressing conventional, toxic, and nonconventional pollutants. In specifying BPT, EPA considers the cost of achieving effluent reductions in relation to the effluent reduction benefits. The Agency also considers the age of the equipment and facilities, the processes employed and any required process changes, engineering aspects of the control technologies, non-water quality environmental impacts (including energy requirements), and such other factors as the Agency deems appropriate. Limitations are traditionally based on the average of the best performances of facilities within the industry of various ages, sizes, processes, or other common characteristics. Where existing performance is uniformly inadequate, EPA may require higher levels of control than currently in place in an industrial category if the Agency determines that the technology can be practically applied.

bioavailable: Degree of ability to be absorbed and ready to interact in organism metabolism. (http://www.epa.gov/OCEPAterms)

biological oxygen demand: A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. The greater the BOD, the greater the degree of pollution. (http://www.epa.gov/OCEPAterms/bterms.html)

chemical oxygen demand: A measure of the oxygen required to oxidize all compounds, both organic and inorganic, in water. (http://www.epa.gov/OCEPAterms/cterms.html)

Clean Water Act: Act passed by the U.S. Congress to control water pollution. Formerly referred to as the Federal Water Pollution Control Act of 1972 or Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500), 33 U.S.C. 1251 et. seq., as amended by: Public Law 96-483; Public Law 97-117; Public Laws 95-217, 97-117, 97-440, and 100-04.

conventional pollutants: Statutorily listed pollutants understood well by scientists. These may be in the form of organic waste, sediment, acid, bacteria, viruses, nutrients, oil and grease, or heat. (http://www.epa.gov/OCEPAterms)

distributional effects: Occurs when the distribution of pollution and environmental harm is not random among the U.S. population, but instead is concentrated among certain population subgroups based on socio-economic or other demographic characteristics, then the uncompensated environmental externalities may produce undesirable transfers of economic welfare among subgroups of the population.

externalities: Costs or benefits of market transactions that are not reflected in the prices buyers and sellers use to make their decisions. An externality is a by-product of the production or consumption of a good or service that affects someone not immediately involved in the transaction.
(http://www.enmu.edu/users/biced/home/glossary.html)
A type of market failure that causes inefficiency.
(http://www.amosweb.com/cgi-bin/gls_dsp.pl?term=externalities)

MP&M facilities: MP&M facilities are defined on the basis of three considerations: (1) they produce metal parts, products, or machines for use in one of the 19 industry sectors evaluated for coverage in the MP&M point source category; (2) they use operations in one of the eight regulatory subcategories evaluated for coverage in the MP&M point source category; and (3) they discharge process wastewater, either directly or indirectly, to surface waters. In this document, the term "MP&M facilities" refers to all facilities meeting the above definition, regardless of whether a facility's industrial sector, subcategory, or discharger category is covered by the final regulation. If the MP&M facilities are referred to as *"regulated"* facilities or facilities *"subject to the final regulation"*, the use of the qualifier *"regulated"* or *"subject to the final regulation"* restricts the definition to include only those facilities in the industry sectors, subcategory, and discharger category covered by the final regulation.

MP&M industry: The facilities and markets comprising the 19 industry sectors evaluated for coverage in the MP&M point source category. In this document, the term "MP&M industry" refers to the full 19 industry sectors, regardless of whether an industry sector is covered by the final regulation. If the MP&M industry is referred to as the *regulated* MP&M industry, the use of the qualifier "regulated" restricts the definition to only the industry sectors, subcategory, and discharger category covered by the final regulation.

nonconventional pollutants: Any pollutant not statutorily listed or which is poorly understood by the scientific community.
(http://www.epa.gov/OCEPAterms)

oil and grease (O&G): These organic substances may include hydrocarbons, fats, oils, waxes and high-molecular fatty acids. Oil and grease may produce sludge solids that are difficult to process. (http://www.epa.gov/owmitnet/reg.htm)

Pretreatment Standards for Existing Sources (PSES): Categorical pretreatment standards for existing indirect dischargers, designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs. Standards are technology-based and analogous to BAT effluent limitations guidelines.

priority pollutants: 126 individual chemicals that EPA routinely analyzes when assessing contaminated surface water, sediment, groundwater or soil samples.

publicly-owned treatment works: A treatment works for municipal sewage or liquid industrial wastes that is owned by a State or municipality.

socially optimal level: Situation in which it is impossible to make any individual better off without making someone else worse off. Also referred to as Pareto optimal.

social welfare: The sum of the welfare of all participants in the society; measured by the sum of consumer surplus --the value consumers derive from goods and services less the price they have to pay for the goods and services -- and producers' surplus -- the revenue received by producers of goods and services less their costs of producing the goods and services.

third parties: Those affected by a by-product of the production or consumption of a good or service that are not immediately involved in the transaction.

total suspended solids: A measure of the suspended solids in wastewater, effluent, or water bodies, determined by tests for "total suspended non-filterable solids."
(http://www.epa.gov/OCEPAterms/tterms.html).

toxic-weighted pollutants: This measure weights quantities of different pollutants in effluents by a measure of their relative toxicity. Toxic-weighted loadings measures the relative toxic effects of discharges containing different mixtures of pollutants.

uncompensated: Where parties damaged by externalities receive no compensation for accepting the damage.

ACRONYMS

BAT: Best Available Technology Economically Achievable
BPT: Best Practicable Control Technology Currently Available
BOD: biological oxygen demand
COD: chemical oxygen demand
CWA: Clean Water Act
MM&R: Machinery Manufacturing and Rebuilding
MP&M: Metal Products and Machinery
NPDES: National Pollutant Discharge Elimination System
NRDC: Natural Resources Defense Council
O&G: oil and grease
POTW: publicly-owned treatment works
PSES: Pretreatment Standards for Existing Sources
TSS: total suspended solids

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Chapter 3: Profile of the MP&M Industry Sectors

INTRODUCTION

The final MP&M rule will apply to facilities that manufacture, rebuild, or maintain metal parts, products or machines to be used in a large number of industrial sectors. ***Manufacturing*** is the series of unit operations necessary to produce metal products, and is generally performed in a production environment. ***Rebuilding/maintenance*** is the series of unit operations necessary to disassemble used metal products into components, replace the components or subassemblies or restore them to original function, and reassemble the metal product. These operations are intended to keep metal products in operating condition and can be performed in either a production or a non-production environment. Manufacturing and rebuilding/maintenance activities often occur at the same facilities.

The MP&M industry encompasses a large number of industries that manufacture intermediate and final goods, support transportation and other vehicle services, and repair and maintain products and equipment. The health of the MP&M industry is generally tied to the overall economic performance of the economy. The MP&M industry includes manufacturing and non-manufacturing industries defined by 224 4-digit ***Standard Industrial Classification (SIC)*** codes, which are grouped into nineteen industry sectors.[1] Of the 224 SIC codes, 174 are manufacturing (SICs 20 through 39) and 50 are non-manufacturing. All nineteen sectors include manufacturing industries, and eleven include non-manufacturing industries as well.

Although EPA evaluated regulatory options that would have covered facilities operating in any of the nineteen sectors, the final regulation covers facilities operating only in sixteen of those sectors.

CHAPTER CONTENTS

This chapter provides a profile of the industry sectors that were evaluated for coverage by the MP&M rule. The profile focuses on the economic characteristics of the sectors and the facilities within the sectors, which may affect the rule's financial and economic impacts. It presents and interprets a wide variety of data associated with production, market structure, and competitiveness, for each sector and for the MP&M industry as a whole.

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[1] Appendix A lists the nineteen sectors and their associated 4-digit SIC codes.

3.1 DATA SOURCES

This profile presents data from the *Economic Censuses, Statistics of U.S. Businesses* (SUSB), *Annual Survey of Manufacturers (*ASM*)*, *U.S. Industry and Trade Outlook*, EPA's Sector Notebooks, and other sources, to characterize the MP&M sectors, including both dischargers and non-dischargers.

The years 1988 and 1996 were chosen as the years for which data are presented because these are the base analysis years, respectively, for the MP&M Phase 1 sectors survey and the Phase 2 survey. In the cases when data for those years were not available, data from other years were used.

This profile relies on industries defined by SICs, both because data collection for the MP&M sectors was defined by SICs and to allow use of historical data. The Census Bureau switched to use of the new ***North American Industry Classification System (NAICS)*** codes starting with the 1997 Economic Censuses. Data classified by NAICS code were converted to SIC format before being included in the profile. The conversion used a bridge containing the percentage of each NAICS code that needed to be assigned to each SIC code. For a detailed discussion of the bridge, see Appendix A.

The Agency used survey data to characterize the facilities within the MP&M sectors that are potentially subject to the rule because they discharge process wastewater from MP&M operations. The survey provides data such as discharge type, small business status, sources of revenues, and financial performance.

The survey requested information on the sectors from which each facility derives its revenues. Many facilities derive revenues from more than one sector. It is therefore difficult to link facility characteristics to a specific sector. Data on the potentially-regulated facilities are therefore summarized by the regulatory subcategories rather than by sectors.

All monetary values are shown in real 2001 dollars. EPA used the ***Producer Price Index (PPI)*** for industrial commodities as a conversion tool. A PPI is an index that measures price changes, from the perspective of the seller, of a collection of goods and services that are important inputs for a specific industry or for the economy as a whole. This chapter uses the PPI for industrial commodities to inflate ***nominal values*** to ***real values***. Later chapters include PPI's that are sector specific. These PPI's are derived from the average of the PPI's for each component industry SIC code, weighted by industry output.

Table 3-1 shows the PPI values for the relevant years for which prices were deflated. The PPI for industrial commodities increased slightly every year between 1988 and 1996. Total inflation for industrial commodities from 1988 to 1996 was 19.8%.

Table 3.1: Producer Price Index for Industrial Commodities

Year	Producer Price Index (PPI)	Percent Change
1988	100.0	n/a
1989	105.0	5.0%
1990	108.9	3.8%
1991	109.6	0.6%
1992	110.4	0.8%
1993	111.9	1.4%
1994	113.5	1.4%
1995	118.1	4.0%
1996	119.8	1.4%
1997	120.1	0.3%
1998	117.4	-2.3%
1999	119.0	1.4%
2000	126.8	6.6%
2001	127.7	0.7%

Source: Bureau of Labor Statistics, Producer Price Index.

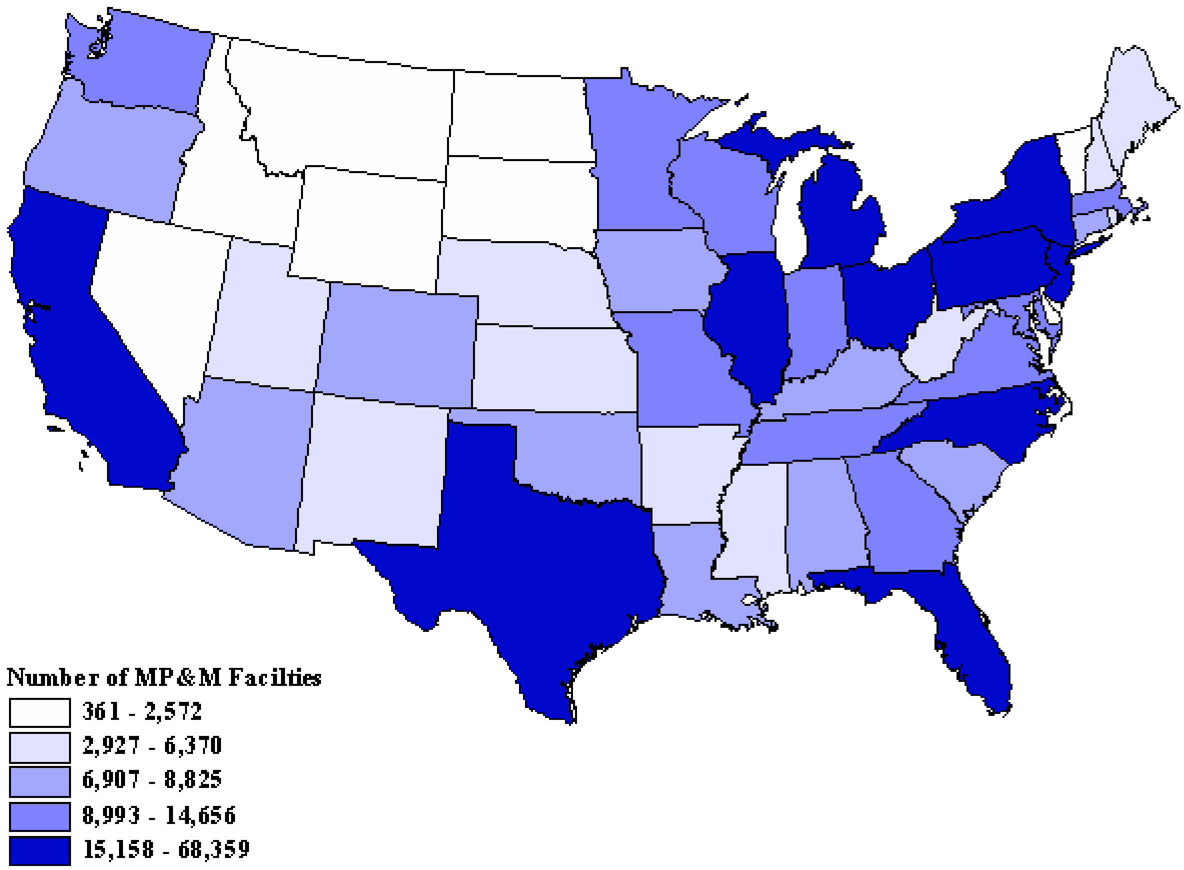
3.2 Overview of the MP&M Industry and Industry Trends

This section provides a general overview of the MP&M industry. It describes the individual MP&M industry sectors, provides basic economic information about MP&M manufacturers, and summarizes recent industry trends.

Figure 3-1 shows that MP&M facilities are located in every state. A few MP&M sectors such as shipbuilding are concentrated geographically. Transportation-related MP&M facilities are found throughout the country. Overall, MP&M

facilities are most concentrated in the heavy industrial regions along the Gulf Coast, both the East and West Coasts, and the Great Lakes Region (New York, Pennsylvania, Ohio, Indiana, Illinois, and Michigan).

Figure 3.1: Number of MP&M Facilities by State in 1992



Source: Department of Commerce, Bureau of the Census, Census of Manufacturers, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries, 1992.

Table 3.2 lists the MP&M sectors and provides a brief description of the products and services produced by each. Appendix A provides a more detailed list of the 4-digit SIC codes in each sector.

Table 3.2: MP&M Sector Definitions

Sector	Sector Description
Aerospace	Metal parts or products such as missiles, space vehicles, satellites and associated launching equipment.
Aircraft	Metal parts or products including all types of aircraft for public, private or commercial use. Includes aircraft parts and equipment as well as aircraft maintenance activities.
Bus and Truck	Metal parts or products including freight trucks and trailers as well as public, private and commercial buses. Includes all associated equipment including equipment specific to truck and bus terminals. Includes bus and truck maintenance activities.
Electronic Equipment	Metal parts or products including general electronic components such as tubes, capacitors, and transformers, as well as finished electronic equipment such as televisions, radios, and telephones.
Hardware	Metal parts or products such as tools, cutlery, valves and tubing, dies, springs, sheet metal, drums, and heat treating equipment.
Household Equipment	Metal parts or products including appliances such as refrigerators, laundry equipment, lighting equipment, cooking equipment, and vacuum cleaners. Non-communication type radios and televisions are included in this sector.
Iron and Steel	Sites engaged in iron or steel manufacturing, forming and finishing.
Instruments	Metal parts or products such as laboratory and medical equipment, measuring devices, environmental and process controls, optical equipment, surgical and dental equipment, and pens.
Metal Finishing Job Shop	Facilities with more than 50 percent of their revenues coming from work on products not owned by the site. While there are SIC codes associated with some Metal Finishing Job Shops, they sell to a variety of markets and are not a market in and of themselves.
Mobile Industrial Equipment	Metal parts or products including tractors and other farm equipment, construction machinery and equipment, mining machinery and equipment, industrial cranes and hoists, and tracked military vehicles.
Motor Vehicle	Metal parts or products including private passenger vehicles and associated parts and accessories such as automobiles, motorcycles, utility trailers and recreational vehicles, and mobile homes.
Office Machines	Metal parts or products including office computer equipment, storage devices, printers, photocopiers and associated parts and accessories.
Ordnance	Metal parts or products including all small arms, artillery, and ammunition with the exception of missiles (aerospace). Does not include the chemical processing or the manufacture of explosives.
Other Metal Products	Metal parts or products including products and machinery not categorized into the other sectors (e.g., sporting goods, musical instruments).
Precious Metals and Jewelry	Metal parts or products including jewelry, silverware, trophies, and clocks as well as all associated parts and accessories.
Printed Wiring Boards	Metal parts or products including printed wiring boards and printed circuit boards.
Railroad	Metal parts or products including railcars, locomotives and associated parts and accessories as well as track, switching and terminal stations.
Ships and Boats	Metal parts or products including ships and boats for military, freight, and private recreation. Includes submarines, ferries, tug boats, barges, yachts, and other recreational boats as well as all parts and accessories. Also includes rebuilding and maintenance activities performed at marinas, dry docks, and other on shore activities specifically related to ships and boats.
Stationary Industrial Equipment	Metal parts or products including all industrial machinery, such as turbines, oil field machinery, elevators and moving stairways, conveying equipment, chemical process industry equipment, pumps, compressors, blowers, industrial ovens, vending machines, commercial laundry equipment, commercial refrigeration and heating equipment, welding apparatus, motors, and generators.

Source: U.S. EPA analysis.

Table 3.3 shows output by sector for manufacturers, non-manufacturers, and all MP&M firms. Output is a good indicator of the overall size of a market. In 1997, MP&M firms accounted for more than $2.8 trillion in output. Motor vehicles were the largest single MP&M sector, accounting for 43 percent of all MP&M output. Ordnance is the smallest sector, with 0.2 percent of MP&M output.

The MP&M manufacturing and non-manufacturing sectors differ in several important ways. The manufacturing sector accounted for $1.6 trillion in output, equal to 57 percent of the total MP&M output. The non-manufacturing sector accounted for $1.2 trillion, or 43 percent of MP&M output. Although MP&M non-manufacturers' revenues were nearly $400 billion smaller than manufacturers' revenues, the MP&M non-manufacturers had three times as many facilities as the MP&M manufacturers. Also, although manufacturing output was relatively evenly divided among the different sectors, more than 86 percent of non-manufacturing output came from the motor vehicle and bus and truck sectors.

Table 3.3: MP&M Output and Share in 1997[a] (millions, 2001$)

Sector	Manufacturers		Non-Manufacturers		Sector Total	
	Output [b]	Share	Output [b]	Share	Output [b]	Share
Aerospace	20,115.1	1.2%			20,115.1	0.7%
Aircraft	105,163.8	6.4%	9,935.9	0.8%	115,099.7	4.0%
Bus & Truck	15,118.4	0.9%	209,316.1	16.7%	224,434.5	7.8%
Electronic Equipment	145,886.9	8.9%			145,886.9	5.1%
Hardware	189,145.5	11.6%			189,145.5	6.6%
Household Equipment	102,242.3	6.3%	2,847.7	0.2%	105,090.0	3.6%
Instruments	141,548.0	8.7%	7,401.9	0.6%	148,949.9	5.2%
Iron and Steel	20,403.0	1.2%			20,403.0	0.7%
Job Shop [c]	15,360.2	0.9%			15,360.2	0.5%
Mobile Industrial Equipment	54,704.7	3.3%			54,704.7	1.9%
Motor Vehicle	366,448.7	22.4%	870,450.5	69.6%	1,236,899.2	42.8%
Office Machine	119,783.0	7.3%	30,929.9	2.5%	150,712.9	5.2%
Ordnance	5,778.8	0.4%			5,778.8	0.2%
Other Metal Products	60,249.6	3.7%	22,040.7	1.8%	82,290.3	2.9%
Precious Metals and Jewelry	9,760.7	0.6%	367.4	0.0%	10,128.1	0.4%
Printed Wiring Boards	10,400.7	0.6%			10,400.7	0.4%
Railroad [d]	8,412.6	0.5%	30,727.9	2.5%	39,140.5	1.4%
Ships and Boats	18,081.1	1.1%	37,383.0	3.0%	55,464.1	1.9%
Stationary Industrial Equipment	227,053.7	13.9%	29,747.1	2.4%	256,800.8	8.9%
Total MP&M	**1,635,656.8**	**100.0%**	**1,251,148.1**	**100.0%**	**2,886,804.9**	**100.0%**
Percent of total	*56.7%*		*43.3%*		*100.0%*	

[a] Data for 1996 were not available, so economic census data from 1997 were used.
[b] Value of shipments for manufacturing industries; total sales for retail and wholesale trade; total receipts for service industries; total revenue for transportation.
[c] Includes facilities in two SICs that are defined specifically as job shops (SICs 3471 and 3479.) Facilities reporting in other sectors may also operate as job shops, so these data are likely to understate the true output of MP&M job shops.
[d] Non-manufacturing railroad data are estimated based on 1992 data.

Source: Department of Commerce, Bureau of the Census, Census of Manufacturers, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries, 1997.

The following sections describe the MP&M sectors and briefly discuss recent industry trends in each sector. The discussion is based on *2001 Value Line Industry Reports, U.S. Industry and Trade Outlook 2000* (DRI-McGraw Hill), EPA's Sector Notebooks, and other sources.

3.2.1 Aerospace

The aerospace industry includes original equipment manufacturers (OEM) and facilities that rebuild and repair aerospace equipment. The industry serves both military and commercial end-uses such as space vehicles for commercial communication satellites, although military applications dominate. Its products include guided missiles, space vehicles, and associated propulsion units and parts. The assembly of aerospace products draws on numerous other industries, including plastics, rubber, fabricated metals, metal casing, glass, textile, and electronic components. Aerospace products are typically produced by a prime contractor and several tiers of subcontractors. Final assembly is performed by relatively few facilities, only a small number compared with the numerous subassembly and parts manufacturers. Aerospace manufacturing is extremely capital intensive.

The U.S. aerospace industry has consolidated substantially in recent years, due to declines in defense spending. The number of facilities and firms as well as sector value of shipments and ***employment*** decreased from 1988 to 1996 in the US.

Growth in the industry is expected to come from lower cost air-to-air missiles, with strong focus on increasing efficiency in production by reducing costs. Consumer demand has also grown for direct-to-home television, voice and data transmission, and other satellite services, which have increased the commercial demand for space vehicles needed to launch satellites.

The aerospace industry exports a substantial share of its output. Many North American and European governments with large defense budgets have been seeking to reduce their military budgets, while governments in South America (with smaller budgets) have been maintaining or increasing their defense spending. Substantial consolidation has occurred in the European aerospace industry, which has become more competitive with U.S. companies (U.S. EPA 1997; DRI/McGraw Hill 2000).

3.2.2 Aircraft

Trends in the aircraft sector are heavily influenced by changes in industry structure and in the international political-economic arena. Although new aircraft production increased substantially in 1998 and 1999, production weakened in 2001 because of the economic slowdown and then plummeted following the September 11th terrorist attacks. Airlines have reacted to falling ticket sales by cutting scheduled flights, reducing personnel, and delaying or cancelling investment in new aircraft.

During the 1990's, there was substantial restructuring through mergers and consolidation in the aircraft manufacturing industry, including producers of both aircraft and aircraft parts nationally and internationally. Firms focused on improving efficiency through cost cutting efforts such as reduced staffing. In addition, there is a growing trend for U.S. producers to outsource many aircraft parts to firms in other nations, in order to bring down costs and compete internationally.

In addition to aircraft manufacturing, this sector includes rebuilding and repair of aircraft at manufacturers' facilities or at airports.[2] The aircraft maintenance and repair industry has slowed with the post 9/11 decline in passenger travel.

3.2.3 Electronic Equipment

The electronic equipment sector can be divided into two general groups of industries: microelectronics manufacturers and telecommunications equipment manufacturers.

Microelectronics industries manufacture a wide range of products, from electronic connectors to integrated circuit panels. These products are used as material inputs in many industries such as automotive, telecommunications, aerospace, computer, and medical equipment. Although the microelectronics industry covers a diverse array of products, producers, and end-uses, some general trends have been evident in the industry. A strong increase in the use of microelectronic products in industries throughout the economy has led to rapid growth in microelectronics manufacturing over the past two decades. Although the US is a major producer of consumer electronics, Japan is the world's leading producer of consumer electronics, and U.S. firms face strong international competition for cutting edge technological advances in their products. Due to the high skill level necessary in the development of products, there is considerable competition for skilled labor. The recent economic slowdown has led to lowered demand for end-products that incorporate microelectronics. In response, the microelectronics

[2] The rule regulates wastewater generated from washing vehicles only when it occurs as a preparatory step prior to performing an MP&M unit operation (e.g., prior to disassembly to perform engine maintenance or rebuilding). The rule does not cover the washing of cars, aircraft, or other vehicles when it is performed only for aesthetic/cosmetic purposes.

industry has reduced capacity and laid off workers to reduce costs. Despite this decline, microelectronics continue to be an increasingly necessary component of the global economy.

Telecommunication industries focus on the production of network equipment, fiber optics, and wireless communication equipment. Much of the growth in the industry has come from the increasing use of fiber optics and wireless end-user devices. The telecommunications industries experienced rapid growth in the nineties; however, industry activity slowed considerably with the collapse of the telecommunications bubble. Telecom firms have reacted by cutting employees, reducing costs, and selling off portions of their firms. Most have continued their R&D efforts.

3.2.4 Hardware

The hardware sector consists of many different industries, which can be generally classified into three groups: building hardware, conventional hardware, and tooling hardware.

Building hardware consists of a group of industries that manufacture metal building products, including fabricated structural metal, sheet metalwork, and architectural metalwork. This group of industries grew rapidly throughout the 1990's. The building products industry as a whole saw record sales in 1998 and again in 1999. Much of this growth is attributed to large highway projects funded by the Transportation Efficiency Act for the 21st Century.

Conventional hardware includes products such as screws, industrial fasteners, and valves and hose fittings. The products produced in this industry are used in the production of manufactured goods. Trends in this industry, therefore, generally reflect trends in other manufacturing industries. One of the most important industries influencing conventional hardware is the auto industry. Hardware producers have experienced pressures from end users such as auto makers to reduce costs. The industry faces a continued trend of consolidation of firms and increasing global pressure from countries with low labor costs. Domestic producers of screws and industrial fasteners saw growth in the real value of shipments due to the strong U.S. economy in the late nineties.

The tooling hardware sector also contains a variety of different industries that produce various types of tools for different uses. Because these industries also face continued globalization, many of them are impacted by changes in the global economy. The decline in Asian markets in 1998 and 1999 resulted in a sharp decline in the value of shipments for the machine tooling industries. Prior to the 1998 financial crisis, value of shipments were increasing annually. The market for the power-driven segment of hand tools has increased, however, despite troubled overseas markets.

3.2.5 Household Equipment

There are three general groups of industries included in the household equipment sector: household furniture, household appliances, and plumbing equipment. Generally speaking, factors that affect this sector are consistent across these three groups. Low unemployment and increased disposable income stimulated growth in each of these industries in the nineties. However, because purchases of household equipment are relatively expensive and discretionary, consumers cut back spending in the recent recession. All three household equipment industries face international competition, as imports account for a substantial share of domestic consumption.

Metal furniture accounts for 20 percent of the household furniture industry. Metal components are increasingly being added to non-metal furniture. For example, there is a trend to increase the functionality of non-metal furniture by equipping recliners with heat and massage. This could increase the industry’s reliance on metal parts. The industry has integrated vertically, as large manufacturers have begun to open their own retail stores in an effort to differentiate their products.

There are two groups of household appliance manufacturers. Major appliances such as washing machines and refrigerators are produced by relatively few firms. Smaller appliances are characterized by little product differentiation but considerable price competition and are manufactured by a larger number of companies.

Finally, a significant characteristic of the plumbing equipment market is the extent of U.S. dependence on foreign imports. While the U.S. construction market has grown at a record pace in the past few years, increasing demand for plumbing equipment, much of the demand has been served by imports and this industry has a trade deficit.

3.2.6 Instruments

The instruments sector is characterized by a diverse array of technologically advanced products and intense global competition among many firms of varying sizes. The sector can be generally divided into industrial measuring and testing instruments, and medical instruments.

In the industrial measuring industry, producers of laboratory instruments are typically integrated firms who have consolidated and reduced costs in response to pressures from medical and pharmaceutical customers. Producers of measuring devices are also facing pressures to consolidate. These firms have been hurt by low commodity prices during the past few years, which have led to reduced investment in measuring equipment by fuel and grain producers. Sales should rebound, however, if Asian economies and fuel prices continue to grow. Small companies still dominate the electronic test equipment industry, which is characterized by a high degree of product differentiation. Most of these firms are not large enough to export products.

Sales for medical devices increased steadily throughout the 1990's, while employment remained relatively constant. The industry has historically been characterized by many small to mid-size firms and intense competition for technological innovation. Efforts to bring down health care costs is one of the primary challenges facing this industry. Pressure to reduce costs has reduced insurance companies' willingness-to-pay for new equipment. As the population ages, however, demand for medical services and devices is expected to grow. The industry will likely continue to grow in the next few years, but at a slower pace than it has grown historically..

3.2.7 Iron and Steel

The basic iron and steel industry is regulated under 40 CFR 420, and primary iron and steel works, blast furnaces and rolling mills are not affected by the MP&M rule. The MP&M rule will regulate facilities that perform MP&M operations or cold forming operations on steel wire, rod, bar, pipe, or tube. This subcategory does not include facilities that perform those operations on base materials other than steel, nor does it include wastewater from cold forming, electroplating or continuous hot dip coating of steel sheet, strip, or plates or wastewater from performing any hot steel forming operations.

Events in the global steel industry in the past few years have had significant and possibly far reaching impacts on domestic producers. In 1998, the industry experienced a global steel crisis. This crisis was caused in part by the Asian financial crisis, which triggered a sharp decline in imports of steel by major steel importing countries of Asia. This led to a flood of steel imports into U.S., and U.S. steel imports rose 33 percent in 1998. The situation was made worse by global overcapacity largely derived from producers in Russia and Latin America.

This flood of steel into the U.S. and Europe led to rapidly declining steel prices in both regions. Excess inventories that accrued during the surge of imports hurt domestic producers. The "unfair" trading prices resulted in over 20 nations taking formal trade protection actions such as import duties and price floors. The US Congress determined that foreign steel was being sold in the US at unfair prices, and reacted by enacting anti-dumping tariffs. The slowdown in the US economy has also negatively affected the steel industry. Most steel firms are being forced to focus on rationalizing capacity and cutting costs.

3.2.8 Job Shops

MP&M metal finishing job shops are defined as those facilities with more than 50 percent of their revenues coming from products not owned by the site. While there are specific SIC codes associated with some Metal Finishing Job Shops, they sell to a variety of markets and are not a market in and of themselves.

3.2.9 Mobile Industrial Equipment

Mobile industrial equipment includes a number of different industries that produce machinery for different purposes, including construction, farming, and mining. Growth in the construction equipment industry is typically tied to economic factors such as housing starts, employment, and consumer confidence. Shipments of construction equipment rose steadily during much of the 1990's. The 1998 Transportation Equity Act for the 21st Century was expected to stimulate further spending by federal, state, and local governments. However, the current recession has forced many industry buyers to cut back or cancel orders.

The farm and mining machinery industries both have been suffering from low commodity prices. Both industries experienced growth in shipments throughout much of the 1990's, but were hit in 1999 by low prices. Farm equipment was hit hardest as the real value of shipments fell by 38 percent in 1999. Output is expected to continue to decrease until grain surpluses decline and agricultural prices rise. However, the consolidation of farms has also had a significant in impact on this industry. With the increase in farm size, there is growing dependence upon mechanization to farm more acres per farm.

3.2.10 Motor Vehicle and Bus & Truck

The major trend in the motor vehicle and bus and truck industries is the continual consolidation of firms into highly capital intensive globalized manufacturers. Motor vehicle manufacturers are no longer constrained within national boundaries, as mergers and joint ventures include some of the largest firms from different countries. Many foreign owned manufacturers have facilities located in the U.S., and relative production costs and exchange rates play a greater role in determining the location of production facilities than the national identity of parent companies.

Manufacturers have increasingly standardized the design of motor vehicles and their parts. These changes have resulted in much less product differentiation among manufacturers, but also in greater product quality. However, greater product quality has resulted in a consistently sharp increase in price over the past three decades. This price increase may have reached its pinnacle in the mid-nineties, since prices declined in 1998 and 1999. Industry output for automobiles increased 1.3 percent between 1996 and 2000. Although the current recession has hurt car prices, manufacturers have used incentives such as zero percent financing to maintain sales volume.

3.2.11 Office Machine

The office machine sector experienced rapid growth in the nineties that reversed itself with the downturn in the economy. The industry experienced 7.8 percent growth in the real value of shipments between 1996 and 2000. While this growth was accomplished with only a 1.3 percent increase in total employment, production employment increased by 5.4 percent. The relative difference between total and production employment can be attributed to increasing reliance on the Internet for sales, thereby reducing the need for non-production sales staff. Despite this increase in production employment, the industry remained extremely capital intensive. The recent weakness of the US economy hit the office machine sector hard with business purchases of computers and computer accessories falling significantly.

Firms in the office machine sector have undergone mergers and acquisitions to bring down costs in order to compete. Firms often rely on joint venturing agreements, and sometimes form alliances with past competitors to produce complementary components of new technologies. Consolidation also allows firms to diversify, providing a range of products such as PCs, software, and information technology to protect against the strong competition in the market for any one product. Firms have also increasingly outsourced production to electronics manufacturers more equipped to increase production and take advantage of economies of size, while the original firms utilize their resources for research and development of new technologies to stay competitive.

Globalization is an important trend in this industry as machine components are produced in different countries. Despite the trend toward a globalized market, the U.S. has held a negative trade balance for over a decade.

3.2.12 Ordnance

The ordnance sector includes firms that manufacture small arms, including grenade launchers and heavy field machine guns; artillery, including naval, aircraft, anti-aircraft, tank, coast, and field artillery; and ammunition, including bullets, bombs, mines, torpedoes, grenades, depth charges, and chemical warfare projectiles. It does not include the chemical processing or manufacture of explosives. Overall, the industry has a high ratio of value added to total sales.

The ordnance sector has contracted significantly since the end of the Cold War. Decreases in US government military spending have caused significant declines in ordnance production, leading to lower industry shipments and cutbacks in employment. Foreign customers, including foreign governments, buy over 80 percent of the ordnance manufactured in the US. Although shipments of military weaponry have declined, sales of small arms have increased in the US over the past few years. Recent military actions by the US will likely result in government weapons purchases that will benefit the industry.

3.2.13 Precious Metals and Jewelry

Domestic production in the precious metals and jewelry industry is dominated by many small firms with low capital intensity, mostly concentrated in the northeast US. It is influenced by trends in consumer behavior, the retail market, and global competition. Devaluation in the price of gold due to declining world prices has benefitted the industry because it reduces the cost of making jewelry. Increased disposable income fueled strong consumer spending on precious metals and costume jewelry in the nineties, but this trend has weakened with the recent economic downturn.

Increases in spending have not always translated into gains for domestic producers. The lowering of tariffs has resulted in a steady increase in imports of costume jewelry, as labor-intensive production is often less expensive in developing countries. Domestic producers have also been hurt by the strong U.S. dollar, which makes U.S. exports more expensive. Another challenge comes from the retail market, which has put strong pressure on producers to bring down prices in order to compete. These challenges include consolidation of retailers, giving them greater purchasing power, increased Internet and television home shopping, and a decrease in the number of wholesalers.

3.2.14 Printed Wiring Boards

Printed wiring boards (also referred to as printed circuit boards) are the physical structures on which electronic components such as semiconductor and capacitors are mounted. Computers and communications are the largest uses for printed wiring boards. In addition, printed wiring boards are used in a wide array of other products, including toys, radios, television sets, electronic wiring in cars, guided-missile and airborne electronic equipment, biotechnology, medical devices, digital imaging equipment, and industrial control equipment. While some producers of PWBs produce them for their own use, most manufacturers are independent firms that sell PWBs to the open market. The majority of PWB manufacturers are small firms.

The domestic PWB industry experienced considerable growth throughout the 1990's. Real industry output grew nine percent from 1996 to 2000. Growth was spurred by continual growth in end-use markets. In addition to the increased in value of shipments, U.S. firms saw a 5.6 percent increase in average hourly earnings and a 16.3 percent increase in ***capital expenditures*** over the same period. However, demand in the PC, telecommunications, and electronics sectors has weakened recently. In parallel, there is growing international competitive pressure for PWB makers to reduce production costs. Consequently, many of the larger PWB firms are looking to relocate offshore.

3.2.15 Railroad

Railroad service consists of both freight and passenger service. In the past few years, railroad companies have been focusing on improving the efficiency of their lines and services. There has been a continued trend toward consolidation of major freight railroads. Consequently, companies have reduced the number of lines and focused attention on increasing the capacity of fewer lines. Railroads have also begun to focus on guaranteeing deliveries at specific times, which will allow them to compete with the trucking industry.

Since the 1980's railroad traffic increased by 50 percent, while the line network decreased by 39 percent. This was accomplished by increasing capital expenditures for equipment such as new locomotives with greater horsepower, installation of double tracks, and increases in the capacity of non-railroad owned freight cars. Consequently, freight service in the nineties saw the first increase in operating revenue since 1984, although this was coupled with sharp decreases in employment. Passenger service has undergone similar changes to increase efficiency by adding new locomotives and beginning a transition to high speed train service. Total industry output increased 7.6 percent per year from 1988 to 1996. Although transportation volume is sensitive to the generally poor macroeconomic situation, railways have succeeded in cutting costs to maintain earnings.

3.2.16 Ships and Boats

Ship manufacturing experienced continual declines throughout the 1990's. Despite efforts by the Federal Government to stimulate investment in converting the industry from production of military ships to merchant ships, the U.S. Navy remains the primary customer of shipbuilders. The U.S. Navy dramatically reduced its orders for new vessels since the end of the Cold War, and has decommissioned many ships and submarines. The Navy decreased its fleet by 208 ships from 1985 to 1998. Although the Navy plans to add 66 new ships through construction and conversion from 2000 through 2004, this represents a decline of over 60 percent in the procurement of new ships since the 1980's. The ship building industry was helped by the Oil Pollution Act of 1990, which required all oil tankers entering U.S. ports to have double hulls. General economic woes and instability in the Middle East are expected to hurt the ships and boats industry.

This sector also manufactures recreational boats, with sales that reflect overall trends in recreational expenditures. The U.S. boat building business is the world's leading supplier of recreational craft. Despite this, rapid growth in the market for smaller personal water craft (e.g., jet skis) has led to an increase in imports of boats.

3.2.17 Stationary Industrial Equipment

The stationary industrial equipment sector includes firms that manufacture machinery and machinery parts used for oil, paper, and food production, printing and packaging, as well as heaters and air conditioners, electric generating equipment, and motor generators. These industries also produce large metal-working machines used in making parts for other industries.

The industries supplying oil and gas production, paper production, and printing machinery were affected by similar global factors, and consequently followed similar trends. Low petroleum prices affected oil production in 1998. Natural gas production was influenced by the low oil prices, which put pressure on the gas industry to reduce costs in order to compete. These factors led to a decline of 38 percent in real value of shipments for oil production equipment manufacturers in 1998 and 1999. The price of petroleum increased in 1999 and 2000 and machinery shipments rebounded by 9.2 percent. However, natural gas prices fell in 2001, hurting the industry.

Paper manufacturing equipment has suffered from events overseas. Although the U.S. has seen a decline in the production of paper throughout the latter half of the 1990's, the U.S. remains the largest producer of paper manufacturing machinery. The industry therefore relies heavily on exports to sustain growth. With struggling economies overseas, the industry saw a decline in value of shipments from 1996 to 2000. Printing machinery manufacturers realized strong growth during the first half of the 1990's due to increased demand for new digital presses, but a decline in exports resulted in slower growth for the later half of the decade. Global events did not have such an impact on manufacturers of packaging machinery, as the U.S. is not only the leading producer of this equipment but also its leading end-user.

A variety of industries manufacture equipment used to produce energy or to power equipment. Refrigeration, air conditioning, and heating equipment sales tend to follow growth in housing starts and construction of new office buildings. A number of factors contributed to strong growth in this industry throughout the 1990's including record housing starts, record heat in the summer of 1999, replacement of chlorofluorocarbon (CFC) air conditioning units, and a large percentage of new homes being built with central air conditioning. With 66 percent of the existing air conditioners containing CFC technology still in operation, replacement of these machines provides an opportunity for growth in this industry in the future.

Manufacturers of turbines, transformers, and switchboards, all of which are used for the production of electricity, saw considerable growth in the late 1990s as the domestic economy grew. This strength has been limited by the recent recession. A number of advanced technologies have been developed to meet the demands of a deregulated industry. These new technologies are capable of producing electricity from smaller facilities at competitive costs. Implementation of these technologies is not expected to take place for a few years, however, until the effects of deregulation become clearer.

3.3 Characteristics of MP&M Manufacturing Sectors

The data in these analyses come primarily from the *Annual Survey of Manufacturers* and the Small Business Administration, although some data from the 1997 Census were used for important economic indicators that were not available in 1996. The multi-year analyses presented in this section cover a nine year period from 1988 to 1996, the base years for the original Phase 1 and Phase 2 survey data. Although ideally data would have been presented for the ten year period from 1987 to 1996, OMB reclassified a number of 4-digit SIC industries in 1987. This made it difficult to compare SIC codes before and after this reclassification and resulted in incomplete data in the *Annual Survey of Manufacturers* for many SIC codes in 1987. Because the data were incomplete in 1987, 1988 was chosen as the first year of the time series. With the exception of data for non-manufacturing sectors, single-year data focus on the year 1996, the base analysis year for the overall MP&M regulatory analysis. Because the *Annual Survey of Manufacturers* does not include data for non-manufacturing sectors, single-year data for these sectors are for 1997, the most recent year of the *Economic Census*.

3.3.1 Domestic Production

a. Output

The two most common measures of manufacturing output are ***value of shipments (VOS)*** and ***value added (VA)***. Historical trends in these measures provide insight into the overall economic health of an industry. Value of shipments is the sum of the receipts a manufacturer earns from the sale of its outputs. It is an indicator of the overall size of a market or the size of a firm in relation to its market or competitors. Value added is the difference between the value of shipments and the value of purchased non-labor inputs used to make the products sold. It is used to measure the value of production activity in a particular industry. The ratio of VA to VOS is an indicator of the importance of the industry's contribution to the total value of the product. A ratio close to zero indicates that the value of the input materials is much more important than the value of industry processing. A ratio close to one indicates that industry processing is the primary source of value in the product.

Table 3.4 presents Department of Commerce data on VOS and VA for the MP&M manufacturing sectors during the period from 1988 to 1996. VOS for the entire MP&M manufacturing sector grew from 1.27 trillion dollars in 1988 to 1.51 trillion dollars in 1996, for an average annual growth rate of 2.1 percent. VA for the entire industry grew at a slower annual rate of 1.5 percent, from 638 billion dollars to 720 billion dollars. In comparison, US GDP grew at 2.6 percent per year over the same period.

Value added as a percent of value of shipments for the MP&M manufacturing industries as a whole was 48 percent in 1996. This indicates that 48 percent of the value of their output was the result of MP&M processing and 52 percent was the cost of purchased inputs. In general, MP&M processing is important to the value of MP&M output products.

Growth in the individual sectors was generally consistent with the overall trend in MP&M manufacturing of slow positive growth. Fourteen of the nineteen sectors had positive growth in VOS, and thirteen had positive growth in VA. Railroad equipment manufacturers enjoyed the largest average annual growth of 7.6 percent in VOS. Electronic equipment experienced the next largest average growth, with annual growth in VOS averaging 5.1 percent. Only the aerospace and ordnance industries experienced a large decline in VOS and VA over this period. Aerospace VOS declined 7.6 percent per year and ordnance VOS declined 7.3 percent per year. Both decreases were attributable to cutbacks in government defense spending at the end of the Cold War.

VA as a percent of VOS for the individual sectors varied substantially from the manufacturing average of 48 percent. The ordnance sector had the highest ratio of VA to VOS, at 67.6 percent, and the instrument and printed wiring board sectors also had high ratios. In these sectors, industry processing is the most important part of the value of the finished product. Sectors with low ratios of VA to VOS included the iron and steel sector, railroad sector, bus and truck sector and especially the motor vehicle sector, for which VA as a percent of VOS was equal to only 33.7 percent. The value of input materials was the most important contributor to the value of products in these sectors.

b. Number of facilities and firms

The number of facilities and firms in an industry is an indicator of industry size and structure. Changes in the number of firms and facilities can indicate whether or not the industry is experiencing growth, and changes in the ratio of facilities to firms can indicate whether an industry is becoming more integrated.

This profile uses SUSB data to assess the number of firms and facilities in the MP&M manufacturing sector. The SUSB did not begin its survey until 1989, and it did not include firms in its survey until a year later. Thus, facilities data are presented in 1989 and firm data are presented in 1990.

Table 3.5 shows the number of MP&M manufacturing facilities in 1989 and 1996 and the number of firms in 1990 and 1996. Overall, the number of firms grew 2.1 percent annually and the number of facilities grew 1.4 percent annually over this period. By 1996, there were 144,603 manufacturing firms and 153,354 facilities. The average number of facilities per firm was relatively constant, with only a minor decrease from 1.07 in 1990 to 1.06 in 1996. Most MP&M manufacturers are single-facility firms.

Trends in the individual manufacturing sectors were generally consistent with overall trends in manufacturing. The aerospace industry was the only MP&M manufacturing sector to experience significant downsizing during this period, with firms and facilities decreasing annually by 4.1 and 4.2 percent, respectively. The iron and steel industry experienced a more modest decrease in number of firms and facilities. The number of firms and facilities in the printed wiring board sector grew the fastest, by a little over five percent annually.

Table 3.4: Real Value of Shipments and Value Added: MP&M Manufacturing Sectors (millions, 2001$)							
Sector	Value of Industry Shipments			Value Added by Manufacture			
	1988	1996	Average Annual Growth Rate	1988	1996	Average Annual Growth Rate	Value Added as a % of Value of Shipments in 1996
Aerospace	35,991	19,111	-7.6%	24,167	10,645	-9.7%	55.7%
Aircraft	101,554	88,897	-1.7%	51,692	48,204	-0.9%	54.2%
Bus & Truck	9,843	14,362	4.8%	3,622	5,513	5.4%	38.4%
Electronic Equipment	85,498	127,347	5.1%	48,862	67,071	4.0%	52.7%
Hardware	152,597	180,756	2.1%	82,644	98,674	2.2%	54.6%
Household Equipment	87,764	98,763	1.5%	42,595	45,551	0.8%	46.1%
Instruments	118,322	136,377	1.8%	78,160	89,052	1.6%	65.3%
Iron and Steel	19,396	19,963	0.4%	7,228	7,103	-0.2%	35.6%
Job Shops	11,733	14,927	3.1%	6,967	8,307	2.2%	55.7%
Mobile Industrial Equipment	45,150	56,159	2.8%	21,356	24,302	1.6%	43.3%
Motor Vehicle	315,641	387,547	2.6%	107,025	130,627	2.5%	33.7%
Office Machine	86,352	110,084	3.1%	43,008	43,849	0.2%	39.8%
Ordnance	10,241	5,567	-7.3%	6,631	3,761	-6.8%	67.6%
Other Metal Products	58,809	63,995	1.1%	36,039	37,431	0.5%	58.5%
Precious Metals and Jewelry	10,790	9,242	-1.9%	5,018	4,403	-1.6%	47.6%
Printed Wiring Boards	10,162	11,408	1.5%	5,927	6,997	2.1%	61.3%
Railroad	4,195	7,533	7.6%	1,893	2,761	4.8%	36.7%
Ships and Boats	18,802	16,666	-1.5%	10,086	8,424	-2.2%	50.5%
Stationary Industrial Equipment	176,961	236,213	3.7%	97,388	125,443	3.2%	53.1%
Total	**1,359,801**	**1,604,916**	**2.1%**	**680,309**	**768,118**	**1.5%**	**47.9%**
US GDP	**7,189,924**	**8,821,069**	**2.6%**	**n/a**	**n/a**	**n/a**	**n/a**

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufacturers; Economagic

Horizontal integration varied substantially across sectors. The railroad sector, with 1.41 facilities per firm in 1996, was the most horizontally integrated, but the iron and steel and aerospace sectors also had high numbers of facilities per firm. The precious metals and jewelry sector had nearly a one to one ratio between facilities and firms, indicating a very low level of horizontal integration.

Table 3.5: Number of Firms and Facilities: MP&M Manufacturing Sectors

Sector	Number of Firms			Number of Facilities			Facilities per Firm	
	1990	1996	Average Annual Growth Rate	1989	1996	Average Annual Growth Rate	1990[a]	1996
Aerospace	109	85	-4.1%	143	106	-4.2%	1.33	1.25
Aircraft	1,428	1,486	0.7%	1,633	1,691	0.5%	1.16	1.14
Bus & Truck	889	953	1.2%	1,016	1,040	0.3%	1.11	1.09
Electronic Equipment	5,649	6,180	1.5%	6,396	6,693	0.7%	1.08	1.08
Hardware	34,984	37,832	1.3%	37,861	40,044	0.8%	1.06	1.06
Household Equipment	6,787	7,563	1.8%	7,914	8,303	0.7%	1.11	1.10
Instruments	7,963	9,730	3.4%	8,959	10,552	2.4%	1.10	1.08
Iron and Steel	597	583	-0.4%	784	770	-0.3%	1.30	1.32
Job Shop	4,798	5,280	1.6%	5,104	5,549	1.2%	1.04	1.05
Mobile Industrial Equipment	3,318	3,341	0.1%	3,606	3,591	-0.1%	1.07	1.07
Motor Vehicle	4,991	6,044	3.2%	5,977	7,024	2.3%	1.17	1.16
Office Machine	1,828	2,002	1.5%	2,050	2,087	0.3%	1.07	1.04
Ordnance	340	421	3.6%	385	442	2.0%	1.09	1.05
Other Metal Products	11,517	13,819	3.1%	12,069	14,198	2.3%	1.03	1.03
Precious Metals and Jewelry	3,719	3,867	0.7%	3,870	3,892	0.1%	1.01	1.01
Printed Wiring Boards	1,034	1,452	5.8%	1,046	1,530	5.6%	1.06	1.05
Railroad	147	152	0.6%	180	215	2.6%	1.27	1.41
Ships and Boats	2,511	3,195	4.1%	2,708	3,310	2.9%	1.05	1.04
Stationary Industrial Equipment	35,231	40,618	2.4%	37,261	42,317	1.8%	1.04	1.04
Total	**127,840**	**144,603**	**2.1%**	**138,962**	**153,354**	**1.4%**	**1.07**	**1.06**

[a] Calculated using data from 1990 for facilities and firms.

Source: Small Business Administration, Statistics of U.S. Businesses.

c. Employment

Employment is a measure of the level and trend of activity in an industry. While employment growth generally signals economic strength in an industry, strong productivity growth and scale economies can yield growth in revenues that exceeds growth in employment. Changing patterns of labor utilization relative to output are particularly important in understanding how regulatory requirements may translate into job losses both in aggregate and at the community level. This profile presents DOC data on employment for 1988 and 1996.

Table 3.6 shows that employment in the MP&M manufacturing sectors as a whole decreased modestly between 1988 and 1997. Over those years, total employment dropped from 7.98 million to 7.55 million, an average decline of 0.7 percent annually. To put this in perspective, VOS for the entire MP&M manufacturing sector grew about 2.1% annually over the same period of time, signaling that growth in output has been driven by increases in capital expenditures and labor productivity, not by increases in employment.

Although total MP&M industry employment declined over the analysis period, not all sectors experienced employment declines. Employment grew or stayed constant in ten of the nineteen sectors. However, while a number of sectors evidenced large percentage and absolute losses in employment, no sectors showed large percentage gains and only two showed large absolute gains in employment . Employment shrank by 11.6 percent annually in the aerospace sector, 9.1 percent in the ordnance sector, and 5.6 percent in the aircraft sector, due to cutbacks in defense spending following the Cold War. The greatest absolute decline occurred in the aircraft sector, which lost almost 220,000 jobs. The largest percentage increase in employment was in the railroad sector, which gained just 2.1 percent annually. The largest absolute increase in employment over the nine years was in the stationary industrial equipment sector, which gained 127,100 jobs.

Table 3.6: Employment: MP&M Manufacturing Sectors

Sector	Number of Employees		
	1988	1996	Average Annual Growth Rate
Aerospace	223,700	81,000	-11.9%
Aircraft	596,600	376,800	-5.6%
Bus & Truck	63,900	67,700	0.7%
Electronic Equipment	602,500	604,800	0.0%
Hardware	1,246,200	1,307,600	0.6%
Household Equipment	584,900	570,600	-0.3%
Instruments	886,500	753,800	-2.0%
Iron and Steel	65,500	67,900	0.5%
Job Shops	123,300	129,200	0.6%
Mobile Industrial Equipment	232,400	232,600	0.0%
Motor Vehicle	928,000	974,000	0.6%
Office Machine	329,800	259,100	-3.0%
Ordnance	86,500	40,200	-9.1%
Other Metal Products	368,100	361,400	-0.2%
Precious Metals and Jewelry	87,100	65,800	-3.4%
Printed Wiring Boards	80,900	88,300	1.1%
Railroad	25,900	30,600	2.1%
Ships and Boats	182,900	141,300	-3.2%
Stationary Industrial Equipment	1,269,800	1,396,900	1.2%
Total	**7,984,500**	**7,549,600**	**-0.7%**

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufacturers.

d. Capital expenditures

Capital expenditures are an indicator of production characteristics and market structure. Capital expenditures are the amount of money spent annually on capital, which includes equipment, machinery, vehicles, software, buildings, intellectual rights, or any other permanent addition to a firm. Capital does not refer to input materials that are consumed in the course of production. New capital expenditures are needed to modernize, expand, and replace a firm's existing production capacity to meet growing demand or to stay current with new regulations or changing technology.

An industry with high capital stock compared to its employee payroll is considered capital intensive: its production relies more heavily on machinery, software, and other forms of capital than on labor. An industry with high capital requirements can have significant barriers to entry for new firms, making the market less competitive.

Table 3.7 presents DOC data on new capital expenditures by MP&M manufacturing sector.

Table 3.7: New Capital Expenditures: MP&M Manufacturing Sectors

Sector	Capital Expenditures (millions, 2001$)			Capital Expenditures per Facility (2001$)		
	1988	1996	Average Annual Growth Rate	1988/89	1996	Change from 1988/89 to 1996
Aerospace	1,310	522	-10.9%	9,160,839	4,924,528	-4,236,311
Aircraft	3,015	2,156	-4.1%	1,846,295	1,274,985	-571,310
Bus & Truck	161	213	3.6%	158,465	204,808	46,343
Electronic Equipment	3,118	4,482	4.6%	487,492	669,655	182,163
Hardware	3,517	5,624	6.0%	92,892	140,446	47,553
Household Equipment	2,150	2,616	2.5%	271,670	315,067	43,396
Instruments	4,002	4,832	2.4%	446,702	457,923	11,221
Iron and Steel	420	623	5.0%	535,714	809,091	273,377
Job Shops	353	772	10.3%	69,161	139,124	69,963
Mobile Industrial Equipment	1,121	1,121	0.0%	310,871	312,169	1,299
Motor Vehicle	5,697	12,840	10.7%	953,154	1,828,018	874,864
Office Machine	3,044	3,109	0.3%	1,484,878	1,489,698	4,820
Ordnance	196	91	-9.2%	509,091	205,882	-303,209
Other Metal Products	1,768	1,999	1.5%	146,491	140,794	-5,697
Precious Metals and Jewelry	93	156	6.7%	24,031	40,082	16,051
Printed Wiring Boards	430	624	4.8%	411,090	407,843	-3,247
Railroad	78	103	3.6%	433,333	479,070	45,736
Ships and Boats	483	374	-3.1%	178,360	112,991	-65,369
Stationary Industrial Equipment	4,333	7,222	6.6%	116,288	170,664	54,376
Total	**35,288**	**49,480**	**4.3%**	253,940	322,652	68,712

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufacturers.

In general, the MP&M manufacturing sector is relatively capital intensive. In 1988, manufacturing capital expenditures were 38.3 billion dollars. They increased by 4.3 percent annually to reach a total yearly investment in capital of 49.5 billion dollars in 1996. Average yearly capital expenditures per firm increased from $254,000 in 1988 to $353,000 in 1996.

For the most part, changes in capital investment from 1988 to 1996 in the individual manufacturing sectors followed the trend for the MP&M manufacturing sectors as a whole. Capital expenditures in the job shop and motor vehicle sectors grew at over

10% annually. The only sectors for which spending on new capital declined were aerospace, aircraft, ordnance, and ships and boats.

There was large variation in capital expenditures across the MP&M sectors. A few industries stood out as being extremely capital intensive. Aerospace firms spent an average of 4.8 million dollars on capital per firm in 1996, and the aircraft, motor vehicle, and office machine sectors each spent more than one million dollars per firm in 1996. The precious metal and jewelry sector had the lowest levels of capital investment, with only $40,000 spent per firm in 1996.

3.3.2 Industry/Market Structure

A number of factors play an important role in determining market structure for an industry, including the barriers that firms face in entering and exiting the market, the degree to which firms in the market are vertically and horizontally integrated, and the extent to which markets have been globalized. The following sections discuss these factors.

a. Facility size

Facility size is an indicator of economies of scale. The presence of many large facilities can indicate that there are advantages to building on a larger scale, such as dividing labor more efficiently, utilizing equipment more effectively, or getting bulk discounts.

Table 3.8 shows 1997 Census data on the distribution of manufacturing facilities and VOS by employment size category and MP&M sector. The MP&M industry is characterized by a large number of small facilities. The Census data indicate that, in 1997, 98.6 percent of all facilities in the MP&M industry employed less than 500 employees. Those facilities, however, accounted for only 59 percent of the total value of shipments from the manufacturing industries. The 1.4 percent of facilities with 500 or more employees generated 41 percent of the total VOS from the manufacturing industries. These large facilities are likely to enjoy substantial economies of scale.

Table 3.8: Number of Facilities and Value of Shipments by Employment Size Category: MP&M Manufacturing Sectors in 1997

Sector	Number of Facilities					Value of Shipments (millions, 2001$)				
	1 to 19	20 to 99	100 to 499	500 to 2,499	2,500 or more	1 to 19	20 to 99	100 to 499	500 to 2,499	2,500 or more
Aerospace	33	23	20	13	10	42	991	15,993	185	2,916
Aircraft	898	441	270	72	32	716	10,087	74,417	2,744	17,913
Bus & Truck	658	335	154	18	1	675	8,013	573	2,366	3,357
Electronic Equipment	3,450	2,086	1,019	205	21	2,945	37,794	37,178	14,258	54,660
Hardware	26,065	11,854	2,686	189	0	20,669	79,456	3	69,005	25,619
Household Equipment	4,958	2,274	1,110	191	11	3,745	40,843	7,314	13,747	37,067
Instruments	6,741	2,667	1,103	253	20	5,592	44,850	21,168	17,124	52,680
Iron and Steel	278	292	205	13	0	528	11,072	0	4,530	4,254
Job Shop	3,701	1,654	199	6	0	2,103	5,610	0	7,273	343
Mobile Industrial Equipment	2,116	990	383	90	9	1,937	17,351	8,913	7,219	26,684
Motor Vehicle	4,004	1,874	1,206	324	79	3,495	54,221	231,896	13,404	119,088
Office Machine	1,408	485	218	73	21	1,553	16,551	59,499	4,842	35,440
Ordnance	298	77	40	17	2	168	1,472	935	522	2,686
Other Metal Products	11,265	2,375	611	68	3	5,382	21,579	7,473	12,511	16,812
Precious Metals and Jewelry	3,250	480	100	12	0	1,777	3,436	0	2,864	1,666
Printed Wiring Boards	801	412	156	20	0	526	4,322	0	2,022	3,334
Railroad	81	71	54	13	1	99	2,659	1,222	678	3,714
Ships and Boats	3,755	469	179	25	6	1,314	5,714	6,414	2,036	2,404
Stationary Industrial Equipment	30,513	8,555	2,344	343	12	18,793	86,348	10,837	50,039	69,921
Total	104,274	37,413	12,056	1,947	227	72,061	452,366	483,834	227,368	480,558

Source: Department of Commerce, Bureau of the Census, Census of Manufacturers, 1997.

Although the majority of MP&M industry facilities are small, the distribution of facilities by employment size category varies substantially among the 19 MP&M sectors. The aerospace, aircraft, motor vehicle, and railroad sectors all had proportionally high numbers of large facilities. The aerospace sector, in particular, had large economies of scale, with 23 percent of its facilities employing 500 or more employees. The hardware, job shop, other metal products, precious metal, and ships and boats sectors had proportionally large numbers of small facilities. At least 93 percent of facilities in each of these sectors had less than 100 employees.

b. Firm size

This profile uses firm employment size as an indicator of market power and barriers to entry. If the largest firms in an industry own disproportionately many facilities or control a large portion of industry output, then they may have significant market power. These firms can use their large production capacities to control and exploit markets. The presence of many large firms in an industry can also indicate that there are barriers to entry into that industry, such as capital requirements or economies of scale, that give existing firms in the industry a competitive advantage. EPA used 1996 SUSB data to assess the competitiveness of the MP&M manufacturing industries.

Table 3.9 presents the distribution of manufacturing firms, facilities, and VOS by firm employment size and MP&M sector. Overall, most MP&M manufacturing firms were small, but the firms that were big owned many facilities and had disproportionately high receipts. In 1996, 138,492 firms, equal to 96 percent of manufacturers, had fewer than 500 employees. These small businesses owned 92 percent of all facilities but had total sales of only 418.3 billion dollars, equal to 28 percent of total estimated receipts. In 1996, 6,111 firms had 500 or more employees. These firms owned eight percent of all facilities but had estimated receipts of 1.08 trillion dollars, equal to 72 percent of the total for manufacturers. It is likely that there are significant economies of scale in the MP&M manufacturing industries.

Although MP&M manufacturing firms tend to be small, firm size varies significantly among individual sectors. The aerospace, iron and job shops, and railroad sectors had proportionally high numbers of large facilities. In the aerospace sector, 50 percent of facilities were owned by firms with 500 or more employees, and 38 percent of firms had 500 or more employees. In contrast, over 98 percent of firms in the job shop, other metal products, precious metals, and ships and boats sectors had less than 500 employees.

Table 3.9: Number of Firms, Facilities, and Estimated Receipts by Firm Employment Size Category, 1996: MP&M Manufacturing Sectors

Sector	Firms			Facilities			Estimated Receipts (millions, 2001$)		
	1 to 99	100 to 499	500 or more	1 to 99	100 to 499	500 or more	1 to 99	100 to 499	500 or more
Aerospace	51	2	32	51	2	53	n/a	n/a	19,029
Aircraft	1,209	135	142	1,212	158	321	2,453	2,840	93,860
Bus & Truck	805	92	56	810	107	123	2,269	2,638	6,702
Electronic Equipment	4,936	681	563	4,977	786	930	12,156	17,353	81,615
Hardware	34,162	2,345	1,325	34,398	2,968	2,678	66,557	42,561	61,295
Household Equipment	6,408	665	490	6,455	791	1,057	12,799	17,412	66,409
Instruments	8,273	727	730	8,320	842	1,390	17,248	16,243	96,894
Iron and Steel	362	108	113	368	153	249	2,015	4,426	12,737
Job Shops	4,945	240	95	5,001	338	210	7,157	3,487	3,097
Mobile Industrial Equipment	2,875	263	203	2,898	319	374	6,668	6,321	32,129
Motor Vehicle	4,950	614	480	4,987	724	1,313	11,314	21,376	366,635
Office Machine	1,662	167	173	1,668	180	239	5,373	7,535	64,424
Ordnance	358	25	38	358	28	56	329	453	4,213
Other Metal Products	13,097	492	230	13,152	602	444	13,568	10,738	30,677
Precious Metals and Jewelry	3,747	86	34	3,753	89	50	3,559	2,019	2,148
Printed Wiring Boards	1,250	137	65	1,258	150	122	2,231	2,402	5,769
Railroad	99	24	29	101	30	84	326	496	6,271
Ships and Boats	3,003	137	55	3,012	165	133	2,699	2,954	11,501
Stationary Industrial Equipment	37,669	1,691	1,258	37,835	2,002	2,480	52,700	35,623	119,210
Total	**129,861**	**8,631**	**6,111**	**130,614**	**10,434**	**12,306**	**221,420**	**196,877**	**1,084,612**

Source: Small Business Administration, Statistics of U.S. Businesses, 1996.

c. Foreign trade

This profile uses two measures of foreign competitiveness: ***export dependence*** and ***import penetration***. Export dependence is the share of value of shipments that is exported. Import penetration is the share of domestic consumption met by imports. For both measures, a high value indicates a relatively high openness to foreign markets and global competition. This openness has benefits, including providing domestic consumers with a wider selection of products and services at lower prices, and allowing domestic producers to make profits in foreign markets. It can have costs, too, if imports to domestic consumers are unreliable or if foreign competition drives down prices for domestic producers. This profile uses 1996 data from the Department of Commerce to illustrate trends in foreign trade.

Table 3.10 shows that overall, the U.S. is an importer of MP&M manufactured goods, with net imports of 75.7 billion dollars in 1996. In general, MP&M industry sectors face global competition, as illustrated by the number of sectors that had both a high export dependence and import penetration. For example, in the precious metals sector, roughly 77 percent of U.S. consumption was met by imports, while almost 23 percent of U.S. production was sold as exports.

Although overall the US has a large trade deficit in MP&M manufactured goods and services, the US was a net exporter in six of the eighteen sectors for which balance of trade data was available. Eighty one percent of production in the ordnance sector and 67 percent of production in the aircraft sector was consumed overseas. The aircraft sector had the highest absolute net exports, valued at 27.26 billion dollars. A few sectors, especially aerospace, ships and boats, iron and steel, and bus and truck, were relatively closed to global competition, with low levels of imports and exports. Foreign imports had the highest relative importance in the precious metals, office machine, and household equipment sectors. The motor vehicle sector had the highest absolute net imports, valued at 63.12 billion dollars.

Table 3.10: Trade Statistics, 1996: MP&M Manufacturing Sectors						
Sector	**Value of Imports (millions, 2001$)**	**Value of Exports (millions, 2001$)**	**Value of Shipments (millions, 2001$)**	**Implied Domestic Consumption[a]**	**Import Penetration[b]**	**Export Dependence[c]**
(a)	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**
Aerospace	143	143	19,111	19,112	0.7%	0.7%
Aircraft	14,015	41,278	88,896	61,633	22.7%	67.0%
Bus & Truck	410	436	14,362	14,335	2.9%	3.0%
Electronic Equipment	31,478	30,615	127,347	128,211	24.6%	23.9%
Hardware	26,753	20,560	180,756	186,949	14.3%	11.0%
Household Equipment	40,697	16,809	98,762	122,650	33.2%	13.7%
Instruments	18,990	31,462	136,376	123,904	15.3%	25.4%
Iron and Steel	937	263	19,963	20,637	4.5%	1.3%
Job Shop[d]	n/a	n/a	14,927	n/a	n/a	n/a
Mobile Industrial Equipment	10,775	16,634	56,159	50,300	21.4%	33.1%
Motor Vehicle	124,203	61,015	387,546	450,735	27.6%	13.5%
Office Machine	67,082	47,783	110,084	129,384	51.8%	36.9%
Ordnance	647	2,792	5,566	3,421	18.9%	81.6%
Other Metal Products	25,282	11,243	63,996	78,035	32.4%	14.4%
Precious Metals and Jewelry	15,839	4,607	9,243	20,474	77.4%	22.5%
Printed Circuit Boards	2,667	1,947	11,408	12,127	22.0%	16.1%
Railroad	1,208	773	7,533	7,969	15.2%	9.7%
Ships and Boats	1,081	1,080	16,666	16,666	6.5%	6.5%
Stationary Industrial Equipment	38,809	55,835	236,213	219,187	17.7%	25.5%
Total[e]	**421,015**	**345,274**	**1,604,915**	**1,680,656**	**25.1%**	**20.5%**

[a] Implied domestic consumption based on value of shipments, imports, and exports [column d + column b - column c].
[b] Import penetration based on implied domestic consumption and imports [column b / column e].
[c] Export dependence based on value of shipments and exports [column c / column d].
[d] As explained in the text, job shops include only two SICs specific to job shops, and not facilities in other SICs that may be operating as job shops.
[e] Components may not sum to totals due to rounding.

Source: Department of Commerce, Bureau of the Census.

d. Establishment births and deaths

The number of firms starting up and closing each year reflects the competitiveness of an industry. Industries with high numbers of these "births" and "deaths" relative to the total number of firms in the industry are likely to have low barriers to entry or exit. These industries are likely to be competitive. Industries with low number of births and deaths are more likely to have significant barriers to entry and exit, such as capital requirements or economies of scale, that make the industries less competitive. As discussed in previous sections, firms in less competitive industries can manipulate prices to generate profits, while firms in more competitive industries have little control over prices. This profile presents SUSB data from 1989 to

1997 on establishment births and deaths. These data are only available by three digit SIC code, making it impossible to calculate sector specific birth and deaths rates. However, data for the MP&M industry as a whole are presented.

The MP&M manufacturing sector has an annual birth rate of 8.1 percent and an annual death rate of 7.8 percent, indicating that in general the MP&M manufacturing sector is relatively competitive. Three digit SIC industry birth and death rates are much more variable, ranging from 4 percent to up to 15 percent. For a more complete discussion, along with the three digit SIC birth and death rates, see Appendix A.

3.3.3 Financial Condition and Performance

Operating margin is a measure of industry financial performance. Operating margin is defined as VOS less annual payroll and cost of materials, as a percent of VOS, and thus measures pre-tax operating profitability before capital- and financing-related charges. Firms with higher operating margins have more cushion against operating losses as a consequence of fluctuating input prices, and thus are likely to be more stable.

Table 3.11 presents DOC data on operating margins for each MP&M manufacturing industry for the years 1988 and 1996, as well as the change in operating margin between the two years. In 1996, the average operating margin for the MP&M sectors was 29.6 percent. This was a slight increase from 1988, when the average operating margin for the MP&M manufacturers was 28.0 percent. Ten MP&M manufacturing sectors experienced increases in their operating margins during this time period, while nine industries experienced decreases.

Instruments, other metal products, and ordnance were the most profitable sectors, according to this measure, with operating margins around 40 percent. The iron and steel, motor vehicle, railroad, and ships and boats sectors had the lowest operating margins, all near 22 percent. The greatest increases in operating margin occurred in the aircraft, ordnance, and bus & truck industries, which all gained between five and six percent. The greatest decrease occurred in the aerospace industry, which lost 3.5 percent.

Table 3.11: Operating Margin[a]: MP&M Manufacturing Sectors in 1988 and 1996			
Sector	**1988**	**1996**	**Change in Operating Margin**
Aerospace	32.4%	28.9%	-3.5%
Aircraft	20.6%	26.7%	6.1%
Bus & Truck	18.5%	24.4%	5.9%
Electronic Equipment	32.0%	33.8%	1.8%
Hardware	27.5%	29.7%	2.2%
Household Equipment	29.7%	29.5%	-0.2%
Instruments	37.1%	41.1%	4.0%
Iron and Steel	23.2%	22.9%	-0.3%
Job Shops	31.8%	30.8%	-1.0%
Mobile Industrial Equipment	27.9%	28.2%	0.3%
Motor Vehicle	20.9%	22.4%	1.5%
Office Machine	31.7%	30.2%	-1.5%
Ordnance	34.3%	39.6%	5.3%
Other Metal Products	41.9%	40.4%	-1.5%
Precious Metals and Jewelry	27.9%	28.2%	0.3%
Printed Wiring Boards	37.2%	36.8%	-0.4%
Railroad	22.4%	22.1%	-0.3%
Ships and Boats	23.2%	22.5%	-0.7%
Stationary Industrial Equipment	29.4%	31.5%	2.1%
All MP&M Manufacturers[b]	**28.0%**	**29.6%**	**1.6%**

[a] Operating Margin is calculated as (value of shipments - cost of materials - payroll)/value of shipments.
[b] Weighted average by VOS.

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufacturers.

3.4 CHARACTERISTICS OF MP&M NON-MANUFACTURING SECTORS

Eleven of the 18 MP&M sectors include non-manufacturing industries. The non-manufacturing activities are defined by 50 four-digit SIC codes: 26 transportation SIC codes, 18 service SIC codes, five retail trade SIC codes, and one wholesale trade SIC code. MP&M facilities may perform both manufacturing and non-manufacturing activities.

The analyses presented in this section cover 1997 only, because the Census does not collect data annually for non-manufacturing SICs as it does for manufacturers in the Annual Survey of Manufacturers. The profile is based on data from the 1997 Censuses of Transportation, Communications, and Utilities; Service Industries; Retail Trade; and Wholesale Trade.

3.4.1 Domestic Production

a. Output

This profile uses sales and receipts as a measure of output. The sum of the receipts a manufacturer earns from the sale of its outputs is an indicator of the overall size of a market or the size of a firm in relation to its market or competitors. EPA used Department of Commerce data to assess sales and receipts for the MP&M non-manufacturing sectors.

Table 3.12 shows sales and receipts by sector for MP&M non-manufacturers. The MP&M nonmanufacturing sector generated 1.25 trillion dollars in sales and receipts in 1997. Motor vehicle repair and maintenance, with sales and receipts of 870 billion dollars, accounted for almost 70 percent of total sales and receipts. Bus and truck, with sales and receipts of 209 billion dollars, accounted for another 17 percent. These two vehicle sectors made up 87% of total non-manufacturing output. The smallest sector was precious metals and jewelry, which accounted for only 367 million dollars in sales and receipts.

Table 3.12: Sales/Receipts: MP&M Non-Manufacturing Sectors in 1997 (millions, 2001$)

Sector	Output [a]	Share
Aircraft	9,935.9	0.8%
Bus & Truck	209,316.1	16.7%
Household Equipment	2,848	0.2%
Instruments	7,402	0.6%
Motor Vehicle	870,451	69.6%
Office Machine	30,930	2.5%
Other Metal Products	22,041	1.8%
Precious Metals and Jewelry	367	0.029%
Railroad[b]	30,728	2.5%
Ships and Boats	37,383	3.0%
Stationary Industrial Equipment	29,747	2.4%
Total	**1,251,148**	**100.0%**

[a] Total sales for retail and wholesale trade, total receipts for service industries, total revenue for transportation.
[b] Railroad sales/receipts is estimated from 1992 data.

Source: Department of Commerce, Bureau of the Census, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries, 1997.

b. Number of facilities and firms

The number of facilities and firms in an industry is an indicator of the size and structure of an industry. Increases and decreases in the number of firms and facilities can indicate whether an industry is growing or shrinking, and changes in the ratio of facilities and firms can indicate whether an industry is becoming more integrated and concentrated. This profile uses SBA data to assess the number of facilities and firms in the non-manufacturing sector from 1989 to 1996. The SBA changed its survey to include firms in 1990, but data on the number of firms are not available from this source in 1989.

Table 3.13 shows the number of facilities and firms in the MP&M non-manufacturing sectors in 1989/1990 and 1996, with average annual growth rates. The number of firms and facilities grew from 1989 to 1996 in all of the sectors. The average number of facilities per firm shrank slightly over this time period, from 1.13 to 1.11, due to the fact that the number of firms in the non-manufacturing sector grew at 4.5 percent per year while the number of facilities grew at only 3.6 percent per year. In general, most MP&M non-manufacturers are single facility firms.

Although the number of facilities and firms increased for all of the sectors over this time period, not all industries grew at the same rate. The number of facilities in the other metal products sector grew at only 0.6 percent annually, and the number of facilities in the stationary industrial equipment and instruments sectors grew at 1.3 percent annually. In contrast, the number of facilities in the office machine sector grew by 20.2 percent annually and the number of firms in the office machine sector grew by 23.7 percent annually.

Concentration varied across the sectors. Stationary industrial equipment was the most concentrated sector, with an average of 1.45 facilities per firm in 1996. The other metal products, household equipment, and office machine sectors were the least concentrated sectors, with only 1.04, 1.06, and 1.07 facilities per firm, respectively.

Table 3.13: Number of Firms and Facilities: MP&M Non-Manufacturing Sectors

Sector	Number of Firms			Number of Facilities			Facilities per Firm	
	1990	1996	Average Annual Growth Rate	1989	1996	Average Annual Growth Rate	1989/90	1996
Aircraft	2,024	3,281	8.4%	2,463	4,062	7.4%	1.22	1.24
Bus & Truck	74,719	113,840	7.3%	88,128	127,675	5.4%	1.18	1.12
Household Equipment	3,234	3,706	2.3%	3,367	3,935	2.3%	1.04	1.06
Instruments	7,214	7,444	0.5%	8,365	9,185	1.3%	1.16	1.23
Motor Vehicle	183,986	213,355	2.5%	203,592	234,542	2.0%	1.11	1.10
Office Machine	9,206	32,916	23.7%	9,714	35,150	20.2%	1.06	1.07
Other Metal Products	32,865	36,290	1.7%	34,683	37,902	1.3%	1.06	1.04
Precious Metals and Jewelry	1,379	1,625	2.8%	1,535	1,838	2.6%	1.11	1.13
Railroad[a]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ships and Boats	5,739	8,290	6.3%	6,561	9,262	5.0%	1.14	1.12
Stationary Industrial Equipment	14,672	15,075	0.5%	20,880	21,791	0.6%	1.42	1.45
Total	**335,038**	**435,822**	**4.5%**	**379,288**	**485,342**	**3.6%**	**1.13**	**1.11**

[a] The railroad sector has only two non-manufacturing SIC codes, both of which were excluded from the 1997 Census. Thus no data on railroads is available.

Source: Small Business Administration, Statistics of U.S. Businesses.

c. Employment

Employment is a measure of the level and trend of activity in an industry. Payroll is a measure of the skill level of employees and of their value to the production process. While employment growth is often correlated with economic strength in an industry, strong productivity growth and scale economies can result in growth in revenues that could not be predicted from employment trends alone. Trends in labor utilization relative to output are important in understanding how regulatory requirements may translate into job losses both in aggregate and at the community level.

Table 3.14 shows DOC data on employment and payroll for the non-manufacturing MP&M sectors in 1997. Total employment for the non-manufacturing sector was 5.99 million, and total payroll was $201 billion. Average yearly pay/employee was $33,610.

The majority of total employment came from the motor vehicle and bus and truck sectors. The motor vehicle sector had 2.6 million employees, and the bus and truck sector had 2.1 million employees. Together these two sectors accounted for over 78 percent of total employment in the non-manufacturing sector. The precious metals and jewelry sector had the lowest employment, with only 5,599 employees.

Workers in a few industries were highly compensated. The railroad sector paid its workers $58,851 per year, and the office machine sector paid $56,092 per year. On the other extreme, workers in the precious metals and jewelry sector earned only $20,121 per year.

Table 3.14: Employment and Payroll, 1997: MP&M Non-Manufacturing Sectors

Sector	Employment	Share	Payroll (thousands, 2001$)	Share	Pay/Employee
Aircraft	121,210	2.0%	3,286,985	1.6%	27,118
Bus & Truck	2,106,432	35.1%	65,643,990	32.6%	31,164
Household Equipment	25,455	0.4%	935,661	0.5%	36,757
Instruments	76,970	1.3%	2,530,404	1.3%	32,875
Motor Vehicle	2,622,049	43.7%	83,223,310	41.3%	31,740
Office Machine	235,332	3.9%	13,200,240	6.6%	56,092
Other Metal Products	226,069	3.8%	6,981,264	3.5%	30,881
Precious Metals and Jewelry	5,599	0.1%	112,659	0.1%	20,121
Railroad	197,421	3.3%	11,618,460	5.8%	58,851
Ships and Boats	178,560	3.0%	7,221,006	3.6%	40,440
Stationary Industrial Equipment	198,735	3.3%	6,701,350	3.3%	33,720
Total	**5,993,832**	**100.0%**	**201,455,328.90**	**100.0%**	**33,610.44**

Source: Department of Commerce, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries, 1997.

3.4.2 Industry Structure and Competitiveness

A number of factors play an important role in determining market structure for an industry, including the barriers that firms face in entering and exiting the market, the degree to which firms in the market are vertically and horizontally integrated, and the extent to which markets have been globalized. This profile shows facility size and firm size as measures of industry structure and competitiveness in the MP&M non-manufacturing sector.

a. Facility size

Facility size is an indicator of economies of scale. The presence of many large facilities in an industry can indicate that there are advantages to building on a larger scale, such as dividing labor more efficiently, utilizing equipment more effectively, or getting bulk discounts. EPA used data from the 1997 Census to assess facility size for manufacturing facilities.

Non-manufacturing facilities tend to be small. There were 255,602 non-manufacturing facilities, or 52.9 percent, that employed 4 employees or less. These facilities accounted for 7 percent of sales and receipts in the non-manufacturing MP&M sectors. Facilities with less than 20 employees accounted for 88 percent of all non-manufacturing facilities but generated only 24 percent of non-manufacturing revenues. Facilities with more than 100 employees employed less than one percent of total employees, but generated 17 percent of total revenues. Non-manufacturing MP&M facilities appear to experience significant economies of scale.

Although the individual non-manufacturing sectors tended to have small facilities, there was some variation between sectors in facility size. The aircraft sector and the ships and boats sector had relatively large facilities, probably because these sectors are involved with large-scale transportation. For both sectors, 6.3 percent of facilities had more than 100 employees. In contrast, the other metal products and precious metals and jewelry sectors had mostly small facilities. Ninety four percent of facilities in the other metal products sector and 96 percent of facilities in the precious metals and jewelry sector had less than 20 employees.

Table 3.15 presents the number of facilities and total sales by facility employment size category for each category.

Table 3.15: Number of Facilities and Sales/Receipts by Facility Employment Size Category: MP&M Non-Manufacturing Sectors in 1997

Sector	Number of Facilities					Sales/Receipts (millions, $2001)				
	0 to 4	5 to 9	10 to 19	20 to 99	100 or more	0 to 4	5 to 9	10 to 19	20 to 99	100 or more
Aircraft	1,936	936	720	870	299	381	482	879	2,767	5,433
Bus & Truck	67,959	24,548	19,355	21,294	3,573	15,924	16,044	24,189	75,663	81,036
Household Equipment	1,886	735	456	305	37	358	411	551	1,072	457
Instruments	5,535	1,737	988	711	131	1,017	936	1,064	2,473	1,917
Motor Vehicle	126,505	58,372	28,184	23,021	2,548	41,209	45,438	62,030	388,395	180,200
Office Machine	16,849	3,619	2,186	1,935	408	3,598	2,592	3,327	9,285	12,146
Other Metal Products	21,564	7,585	3,813	2,136	138	3,810	3,856	4,444	7,178	2,118
Precious Metals and Jewelry	790	215	88	41	2	109	81	70	88	19
Railroad[a]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ships and Boats	2,605	930	848	1,046	366	2,578	1,580	2,161	9,535	19,380
Stationary Industrial Equipment	9,974	7,601	3,601	2,084	134	3,183	5,487	6,000	9,321	3,189
Total	**255,602**	**106,277**	**60,238**	**53,443**	**7,635**	**72,168**	**76,907**	**104,714**	**505,778**	**305,894**

[a] The non-manufacturing railroad sector is comprised of two SIC codes, both of which were excluded from the 1997 Census.

Source: Department of Commerce, Bureau of the Census, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries, 1997.

b. Firm size

This profile uses firm employment size as an indicator of market power and barriers to entry. The distribution of facilities and output by firm size can indicate that the firms in an industry have market power. If the largest firms own disproportionately many facilities, in which case they are considered horizontally integrated, or if the largest firms control a large portion of industry output, then they may have significant market power. These firms can use their large capacities to control and exploit markets. The presence of many large firms in an industry can also indicate that there are barriers to entry into that industry, such as capital requirements or economies of scale, that give existing firms in the industry a competitive advantage.

Table 3.16 presents SUSB data on numbers of firms and facilities with estimated receipts by firm employment size category in 1996 for MP&M non-manufacturers. In general, although the majority of MP&M non-manufacturing firms were small, the larger firms owned many facilities and had disproportionately large market shares. The vast majority of non-manufacturing firms – 427,173 firms or about 98 percent of non-manufacturers – employed fewer than 100 employees. However, these firms owned only 90 percent of all facilities and earned 610 billion dollars, only 58 percent of all revenues. The 2,338 firms with 500 or more employees, equal to 0.54 percent of all non-manufacturers, owned 6.5 percent of all facilities and generated 207 billion dollars, equal to 19.8 percent of total revenue.

Firm size in the individual MP&M non-manufacturing sectors is relatively similar to the trends in the non-manufacturing sector as a whole. At least 94 percent of the firms in every sector had less than 100 employees. Although firm size varies little by sector, there were larger variations in receipts by firm size. The aircraft, instruments, and ships and boats sectors each had a small percentage of firms that controlled a large share of the market. In the aircraft sector, the largest 2.35 percent of firms generated 60.4 percent of total revenues. In the instruments sector, the largest 1.2 percent of firms generated 50.2 percent of total revenues. In the ships and boats sector, the largest 2.6 percent of firms generated 57.4 percent of total revenues.

Table 3.16: Number of Firms, Facilities, and Estimated Receipts by Firm Employment Size Category, 1996: MP&M Non-Manufacturing Sectors

Sector	Firms			Facilities			Estimated Receipts (millions, 2001$)		
	1 to 99	100 to 499	500 or more	1 to 99	100 to 499	500 or more	1 to 99	100 to 499	500 or more
Aircraft	3,124	80	77	3,189	139	734	2,717	1,264	6,071
Bus & Truck	111,038	2,001	801	112,751	4,334	10,590	79,331	23,943	66,113
Household Equipment	3,669	19	18	3,700	23	212	2,032	275	873
Instruments	7,277	76	91	7,536	206	1,443	3,119	562	3,715
Motor Vehicle	209,814	3,010	531	216,707	7,119	10,716	465,989	186,083	87,113
Office Machine	32,428	290	198	32,745	759	1,646	14,787	4,800	10,565
Other Metal Products	35,788	284	218	36,205	567	1,130	16,749	2,308	4,610
Precious Metals and Jewelry	1,615	6	4	1,661	105	72	269	0	0
Railroad	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ships and Boats	7,833	243	214	8,000	519	743	9,087	6,122	20,493
Stationary Industrial Equipment	14,587	302	186	16,331	1,359	4,101	15,422	4,606	7,739
Total	**427,173**	**6,311**	**2,338**	**438,825**	**15,130**	**31,387**	**609,502**	**229,963**	**207,294**

[a] The non-manufacturing railroad sector is comprised of two SIC codes, both of which were excluded from the 1997 Census.

Source: Small Business Administration, Statistics of U.S. Businesses.

3.5 Characteristics of All MP&M Sectors

This section presents additional market structure data for the MP&M industry as a whole. It includes eight-firm concentration data and risk-normalized ***return on assets (ROA)*** data as measures of industry competitiveness.

3.5.1 Eight-firm Concentration Ratio

The eight-firm ***concentration ratio*** (8-firm CR) is a measure of the degree to which the largest firms in an industry have market power. It is defined as the percentage of the value of total industry shipments that is produced by the top eight firms of a given industry. In general, an industry with a high 8-firm CR are likely to have larger entry and exit barriers and to be less competitive. Firms in this kind of industry have less incentive to compete and more ability to manipulate prices to increase their profits. It is more difficult for firms in a competitive, less concentrated industry to manipulate prices. This profile presents 8-firm CR data from the 1992 Census.

Table 3.17 shows the 8-firm CR for each sector in 1992. The aerospace and aircraft sectors were particularly concentrated, with the largest eight firms in each sector producing 92 percent and 85 percent of industry shipments, respectively. The motor vehicle, ordnance, and railroad sectors were also relatively concentrated. The job shop and hardware industries were the least concentrated, with only 19 percent and 25 percent of output, respectively, being produced by the eight largest firms.

Table 3.17: Eight-firm Concentration Ratio, 1992

Sector	8-firm Concentration Ratio	
	Value	Rank[a]
Aerospace	92.29	19
Aircraft	85.3	18
Bus & Truck	42.51	7
Electronic Equipment	47.27	9
Hardware	24.52	2
Household Equipment	54.22	10
Instruments	44.2	8
Iron and Steel	41.87	6
Job Shop	19.26	1
Mobile Industrial Equipment	58.56	13
Motor Vehicle	77.30	17
Office Machine	61.38	14
Ordnance	76.90	16
Other Metal Products	54.27	11
Precious Metals and Jewelry	35.0	4
Printed Circuit Boards	35.0	3
Railroad	71.00	15
Ships and Boats	58.20	12
Stationary Industrial Equipment	41.16	5

[a] Rank is a comparison within the MP&M manufacturing sectors only. A rank of 1 indicates the lowest level of concentration.

Source: Department of Commerce, Bureau of the Census.

3.5.2 Risk Normalized Return on Assets

Firms' abilities to enter and exit markets determine, in part, the competitiveness of an industry. If significant barriers to entry exist, potential entrants may be dissuaded and existing firms may enjoy market power. If few barriers to entry exist, existing firms are more likely to face competition for market share via price and other competitive tactics. Some important entry barriers for the MP&M industry are large capital requirements, economies of scale, and brand name recognition. Although data on barriers to entry are limited, the available data show that market power exists in some sectors.

EPA used the risk normalized return on assets as an indicator of the existence of entry or exit barriers for each industry [3]. A firm's return on assets is the profit the firm earns from investing in assets. Normally, firms in riskier industries tend to have higher ROA's. However, barriers to entry or exit can allow firms to achieve higher ROA's than would be predicted from their

[3] The risk normalized ROA only assigns MP&M industry sectors relative rankings and does not imply that they face high or low barriers to competition in absolute terms.

risk level. The risk normalized return on assets measures the additional profit that firms earn above and beyond what their risk level predicts. EPA used data from Marketguide.com to calculate a risk normalized ROA. The agency calculated risk normalized ROA by dividing each firm's ROA by its asset beta (a measure of the relative riskiness of the firm's common stock) and averaging over the five-year period from 1996 to 2000.

The electronic equipment, printed circuit board, and office machine industries had the lowest risk normalized ROA's, indicating relatively weaker barriers to entry or exit for these industries. The instrument, other metal products, mobile industrial equipment, and motor vehicle industries had the highest ROA's. These industries are likely to have significant barriers to entry and exit.

Table 3.18 presents the average risk normalized return on assets for the period from 1996 to 2001, based on data from Marketguide.com.

Table 3.18: Average Risk Normalized Return on Assets, 1996 to 2001

Sector	Risk-Normalized ROA (%)	
	Value	Rank
Aerospace	13.19	8
Aircraft	16.15	13
Bus & Truck	12.31	7
Electronic Equipment	7.21	1
Hardware	17.18	15
Household Equipment	12.02	5
Instruments	19.64	18
Iron and Steel	11.38	4
Job Shop	13.44	9
Mobile Industrial Equipment	18.13	17
Motor Vehicle	18.10	16
Office Machine	9.58	3
Ordnance	12.30	6
Other Metal Products	26.60	19
Precious Metals and Jewelry	14.43	10
Printed Circuit Boards	7.50	2
Railroad	14.62	11
Ships and Boats	16.11	12
Stationary Industrial Equipment	16.78	14

Source: www.marketguide.com

3.6 CHARACTERISTICS OF MP&M FACILITIES

This section uses survey data to characterize MP&M facilities. It includes data on facility revenue sources, discharge type, small business status, market type, and financial performance. These data are organized according to MP&M regulation subcategories based on unit operations performed and the nature of the waste generated. EPA determined that a basis exists for dividing the MP&M category into the following subcategories: General Metals, Non-Chromium Anodizing, Metal Finishing Job Shops, Printed Wiring Boards, Steel Forming and Finishing, Oily Wastes, Railroad Line Maintenance, and Shipbuilding Dry Dock. EPA did not generally define subcategories in terms of industrial sectors because many facilities perform operations covered by multiple sectors and, as a result, the industrial sectors are too broad for subcategorization.

Table 3.19 shows the national number of MP&M facilities that sell products to different combinations of sectors. The table shows that many MP&M facilities operate in multiple market sectors. Almost every combination of sectors shows overlap, and some MP&M facilities report revenues from three or more sectors.

Table 3.19: Overlap of Sectors

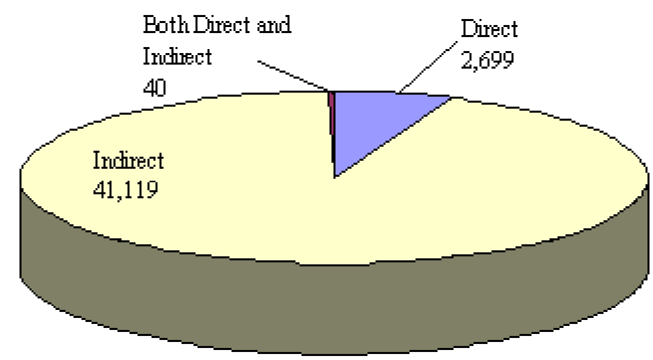
Sector	Aerospace	Aircraft	Bus and Truck	Electronic Equipment	Hardware	Household Equipment	Instrument	Mobile Industrial Equipment	Motor Vehicle	Office Machine	Ordnance	Other Metal Products	Precious Non-Precious Metals	Printed Circuit Boards	Railroad	Ships and Boats	Stationary Industrial Equipment	Unknown
Aerospace	1,828																	
Aircraft	0	2,350																
Bus and Truck	129	169	5,574															
Electronic Equipment	1,327	1,318	824	4,073														
Hardware	345	399	914	1,129	7,075													
Household Equipment	289	317	477	898	1,600	2,635												
Instrument	1,046	1,126	398	1,680	678	610	4,965											
Mobile Industrial Equipment	47	116	1,511	704	738	417	404	2,467										
Motor Vehicle	157	220	1,790	619	823	678	524	1,089	13,853									
Office Machine	265	349	198	622	515	477	356	159	223	1,088								
Ordnance	132	119	52	204	86	77	202	80	153	89	481							
Other Metal Products	289	321	457	850	1,450	1,393	475	438	695	329	36	5,359						
Precious and Non-Precious Metals	47	47	0	36	47	24	47	12	36	36	0	92	1,651					
Printed Circuit Boards	160	164	0	164	160	160	4	0	0	375	0	160	0	1,229				
Railroad	16	61	95	86	143	67	69	124	154	91	58	81	12	26	1,132			
Ship and Boat	102	0	237	146	191	156	104	138	245	138	25	78	12	0	48	1,366		
Stationary Industrial Equipment	1,169	1,255	714	1,818	1,151	687	1,293	688	530	486	130	469	39	164	109	324	4,907	
Unknown																		583

Source: U.S. EPA analysis.

The remainder of this profile focuses on MP&M industry facilities that discharge effluent. Out of a total population of 638,696 MP&M industry establishments reported in the *Statistics of U.S. Businesses* for 1996, approximately seven percent, or 43,858 facilities, are effluent dischargers as identified by the MP&M surveys.

Figure 3.2 shows the breakdown of MP&M facilities by discharge type. Of the effluent dischargers, 41,119 (94 percent) are indirect dischargers, meaning that they discharge into a sewer or a POTW, and 2,699 (6 percent) are direct dischargers that discharge directly into a surface water body. The remaining 40 facilities are both direct and indirect dischargers.

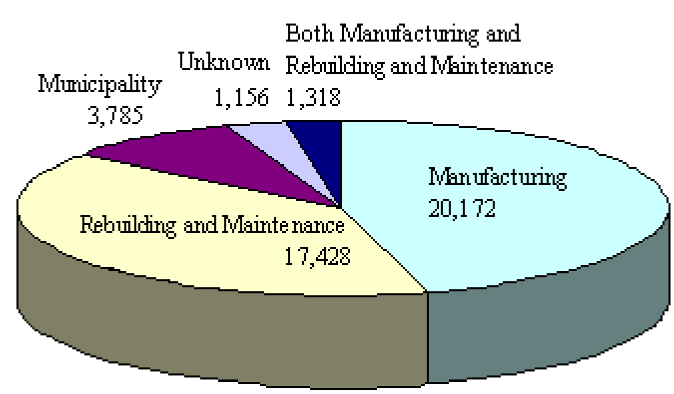
Figure 3.2: Facilities by Discharge Type



Source: U.S. EPA analysis.

Figure 3.3 shows facilities by revenue source. Local governments or municipalities operate 3,785 facilities (9 percent). The remaining 40,073 facilities are privately owned. Of these, 17,428 facilities (40 percent) are rebuilding and maintenance facilities and 20,172 facilities (46 percent) are manufacturing facilities.

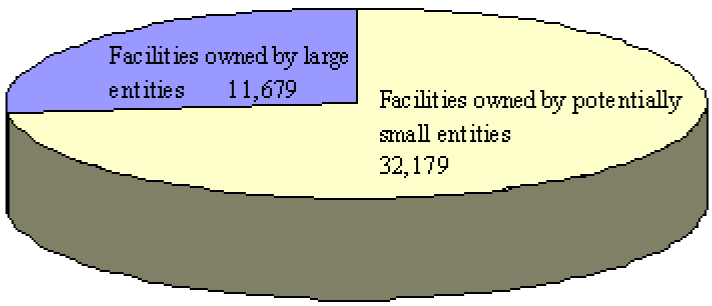
Figure 3.3: Facilities by Revenue Source



Source: U.S. EPA analysis.

Figure 3.4 shows facilities by small entity status. Small Business Administration (SBA) thresholds were used to estimate the number of facilities that are likely to be owned by small businesses, as defined by the SBA. Using the methodology detailed in the Small Entity Impact Analysis (see Chapter 10), EPA determined that 32,179 facilities (73 percent) are owned by small or potentially small entities.

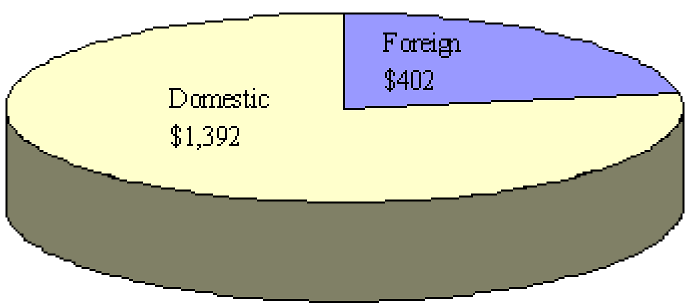
Figure 3.4: Facilities by Small Entity Status



Source: U.S. EPA analysis.

Figure 3.5 indicates that MP&M facilities derive approximately 22 percent of their revenues from export sales. Almost 78 percent of MP&M revenues come from domestic non-government sources. Government purchases account for a very small share of MP&M revenues overall.

Figure 3.5: 1996 Facility Revenues by Market Type (billions, 2001$)



Export data were not available for Iron and Steel surveys.

Source: U.S. EPA analysis.

To characterize baseline financial performance across regulation subcategories, EPA used ***Pre-Tax Return on Assets (PTRA)*** as a measure of industry profitability. PTRA measures the return, before tax, to total capital that company management achieves from its deployed capital assets. Unlike the ROA measure noted above in section 3.5.2, the PTRA reported in this discussion is not adjusted for risk.

Table 3.20 shows that the printed wiring board subcategory has the highest median PTRA (13.4 percent) of all the subcategories. The shipbuilding drydock subcategory has the lowest median PTRA (2.5 percent). The median PTRA for all of the MP&M facilities is 11.1 percent.

Table 3.20: Financial Performance

Subcategory	Median Pre-Tax Return on Assets (PTRA)
Shipbuilding Drydock	2.5%
General Metals	11.5%
Steel Forming & Finishing	9.1%
Metal Finishing Job Shops	9.2%
Non-Chromium Anodizer	9.0%
Oily Wastes	9.6%
Printed Wiring Boards	13.4%
Railroad Line Maintenance[a]	n/a

[a] PTRA data was not available for railroad line maintenance because these facilities were treated as cost-centers in the survey analysis.

Source: U.S. EPA analysis.

GLOSSARY

capital expenditures: expenditures for permanent additions and major alterations to facilities and equipment, as well as replacements and additions to capacity, which are ordinarily depreciated. Reported capital expenditures include work done on contract and expenditures for assets leased from other concerns through capital leases. Expenditures for land and cost of maintenance and repairs charged as current operating expenses are excluded

concentration ratio: the percentage of output from a given industry that is produced by the largest firms in that industry. For example, the eight firm concentration ratio measures the percentage of output that is produced by the eight largest firms in an industry. The concentration ratio is a measure of industry competitiveness.

employment: total number of full-time equivalent employees, including production workers and non-production workers.

export dependence: the share of shipments by domestic producers that is exported; calculated by dividing the value of exports by the value of domestic shipments.

import penetration: the share of all consumption in the U.S. that is provided by imports; calculated by dividing imports by reported or apparent domestic consumption (the latter calculated as domestic value of shipments minus exports plus imports).

manufacturing: series of unit operations necessary to produce metal products; generally performed in a production environment.

North American Industry Classification System: classification system adopted beginning in 1997 to replace SIC codes. NAICS codes will be used throughout North American and allow for greater comparability with the International Standard Industrial Classification System (ISIC), which is developed and maintained by the United Nations. The new system also better reflects the structure of today's economy, including the growth of the service sectors and new technologies.

nominal values: dollar values expressed in current dollars.

operating margin: measure of the relationship between input costs and the value of production, as an indicator of financial performance and condition. Everything else being equal, industries and firms with lower operating margins will generally have less flexibility to absorb the costs associated with a regulation than those with higher operating margins. Operating margins were calculated in this profile by subtracting the cost of materials and total payroll from the value of shipments. Operating margin is only an approximate measure of profitability, since it does not consider capital costs and other costs. It is used to examine trends in revenues compared with production costs within an industry; it should not be used for cross-industry comparisons of financial performance.

pre-tax return on assets (PTRA): the ratio of cash operating income (net income plus depreciation) to the book value of total assets. This ratio is a measure of facility profitability.

producer price index (PPI): a family of indexes that measures the average change over time in selling prices received by domestic producers of goods and services (Bureau of Labor Statistics, PPI Overview). Used in this profile to convert nominal values into real dollar values.

real values: nominal values normalized using a price index to express values in a single year's dollars. Removes the effects of price inflation when evaluating trends in dollar measures.

rebuilding/maintenance: unit operations necessary to disassemble used metal products into components, replace the components or subassemblies or restore them to original function, and reassemble the metal product. These operations are intended to keep metal products in operating condition and can be performed in either a production or a non-production environment.

return on assets: the profit the firm earns from investing in assets. Generally firms in riskier industries have higher returns on assets. A risk normalized return on assets (RNROA) measures the additional profit that firms earn above and beyond what their risk level predicts. The RNROA is a measure of industry competitiveness.

Standard Industrial Classification: classification system used for all establishment-based Federal economic statistics classified by industry. Each establishment is assigned a 4-digit SIC code based on its principal product, or service. Last revised in 1987 and currently being replaced by the NAICS.

value added: measure of manufacturing activity, derived by subtracting the cost of purchased inputs (materials, supplies, containers, fuel, purchased electricity, contract work, and contract labor) from the value of shipments (products manufactured plus receipts for services rendered), and adjusted by the addition of value added by merchandising operations (i.e., the difference between the sales value and the cost of merchandise sold without further manufacture, processing, or assembly) plus the net change in finished goods and work-in-process between the beginning-and end-of-year inventories. Value added avoids the duplication in value of shipments as a measure of economic activity that results from the use of products of some establishments as materials by others. Value added is considered to be the best value measure available for comparing the relative economic importance of manufacturing among industries and geographic areas.

value of shipments: net selling values of all products shipped as well as miscellaneous receipts. Includes all items made by or for an establishment from materials owned by it, whether sold, transferred to other plants of the same company, or shipped on consignment. Value of shipments is a measure of the dollar value of production, and is often used as a proxy for revenues. This profile uses value of shipments to indicate the size of a market and how the size differs from year to year, and to calculate operating margins.

ACRONYMS

NAICS: North American Industry Classification System
PPI: producer price index
PTRA: pre-tax return on assets
ROA: return on assets
SIC: Standard Industrial Classification
VA: value added
VOS: value of shipments

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Chapter 4: Regulatory Options

INTRODUCTION

The preamble for the final rule describes the regulatory options considered by EPA for the final MP&M effluent guidelines. This chapter provides a brief summary of the subcategories and the regulatory options.

CHAPTER CONTENTS

4.1 SUBCATEGORIZATION

EPA may divide a point source category into subcategories to address variations in products, raw materials, processes, and other factors that result in distinctly different effluent characteristics. Defining subcategories makes it possible to establish effluent limitations that take into account technological achievability and economic impacts unique to each subcategory. EPA considered the following factors in defining MP&M subcategories:

- unit operation,
- activity,
- raw materials,
- products,
- size of site,
- location,
- age,
- nature of the waste generated,
- economic impacts,
- treatment costs,
- total energy requirements,
- air pollution control methods,
- solid waste generation and disposal, and
- publicly-owned treatment work ***(POTW)*** burden.

In a way similar to the proposed rule, EPA established subcategories for the final MP&M rule based on unit operations performed. The subcategories are defined in part based on the type of wastewater that facilities discharge, including:

facilities that discharge wastewaters with high metals content, with or without oil and grease ***(O&G)***; and

- facilities that discharge wastewaters containing mainly O&G, with limited metals and other associated organic constituents.

The subcategories identified by EPA in each group are:

Metal-bearing (with or without O&G):

- General Metals,
- Metal Finishing Job Shops,
- Non-Chromium Anodizing,
- Printed Wiring Board,
- Steel Forming & Finishing; and

Oil-bearing only:

- Oily Wastes,
- Railroad Line Maintenance, and
- Shipbuilding Dry Docks.

For the final rule, EPA is establishing limitations and standards only for direct dischargers in the Oily Wastes subcategory. The other subcategories were considered at proposal and for some of the alternative regulatory options but are not further regulated under the final rule. Section VI.B of the preamble accompanying the final rule describes the basis for defining these subcategories. The following are brief summaries of each subcategory:

General Metals: The General Metals subcategory includes facilities that perform operations that generate metal-bearing wastewater.[1] At a minimum, wastewater at these sites requires metals removal and may also require the preliminary treatment steps of oil/water separation, chromium reduction, and cyanide destruction. For example, wastewater generated from most manufacturing operations and heavy rebuilding operations (e.g., aircraft/aerospace, bus/truck, railroad, ship, industrial equipment) would be regulated under the General Metals subcategory as well as sites performing surface finishing operations at a captive shop (i.e., not a metal finishing job shop) including continuous electroplating as defined in today's rule.

Metal Finishing Job Shops: These facilities must perform one or more of the six operations regulated by the existing Metal Finishing (40 CFR 433) and Electroplating (40 CFR 413) effluent guidelines, and must meet the definition of a ***job shop***. The six metal finishing operations are electroplating, electroless plating, anodizing, coating, chemical etching and milling, and printed circuit board manufacture. A job shop is a facility that owns no more than 50 percent of the materials undergoing metal finishing. EPA proposes to regulate Printed Wiring Board facilities that are job shops under this subcategory, but is seeking comment on this proposal.

Non Chromium Anodizing: This subcategory includes facilities that perform aluminum anodizing without the use of chromic acid or dichromate sealants. The wastewater generated at these facilities contains very low levels of metals (except for aluminum) and toxic organic pollutants.

Printed Wiring Board: These facilities manufacture, maintain, and repair printed wiring boards (i.e., circuit boards), not including job shops. They perform some unique operations, including applying, developing, and stripping of photoresist; lead/tin soldering; and wave soldering.

Steel Forming & Finishing: This subcategory applies to facilities that perform MP&M operations or cold forming operations on steel wire, rod, bar, pipe, or tube. Other operations on steel, including any hot forming operations for steel, or cold forming, electroplating, or continuous hot dip coating of other steel products, will be regulated under the revisions to the existing Iron and Steel Manufacturing effluent guidelines (40 CFR 420).

Oily Wastes: The Oily Wastes subcategory is a "catch-all" for sites that discharge wastewater exclusively from oily operations and are not otherwise covered by the Railroad Line Maintenance or Shipbuilding Dry Dock subcategory. Oily operations for the this subcategory are defined in today's final rule as: alkaline cleaning for oil removal, aqueous or solvent degreasing, corrosion preventative coating (as specified in § 438.21(b)); floor cleaning; grinding; heat treating; deformation by impact or pressure; machining; painting (spray or brush); steam cleaning; and testing (such as hydrostatic, dye penetrant, ultrasonic, magnetic flux); iron phosphate conversion coating; abrasive blasting, alkaline treatment without cyanide; assembly/disassembly; tumbling/barrel finishing/mass finishing/vibratory finishing; burnishing; electrical discharge machining; polishing, thermal cutting; washing of final products; welding; wet air pollution control for organic constituents; adhesive bonding; and calibration.

Railroad Line Maintenance: This is one of two specific subcategories that discharge only oil-bearing wastewaters (as defined above for the Oily Wastes subcategory). The Railroad Line Maintenance subcategory includes facilities that discharge from performing routine cleaning and light maintenance on railroad engines, cars, car-wheel trucks, or similar parts or machines. Facilities engaged in the manufacture, overhaul or heavy maintenance of railroad engines, cars, car-wheel

[1] These sites may also perform operations that generate oil-bearing wastewater.

trucks, or similar parts or machines are not covered by this subcategory and depending on the operations performed may be covered by either the General Metals or Oily Wastes subcategory.

Shipbuilding Dry Docks: This is the second of two specific subcategories that discharge only oil-bearing wastewaters (as defined above for the Oily Wastes subcategory). The Shipbuilding Dry Dock subcategory applies to discharges of process wastewater generated in or on dry docks and similar structures, such as graving docks, building ways, marine railways and lift barges at shipbuilding facilities (or shipyards). When generated by operations from within a dry dock or similar structure, this subcategory covers process wastewater generated inside and outside the vessel (including bilge water) and wastewater generated from barnacle removal conducted as preparation for ship maintenance, rebuilding or repair. Wastewaters generated from other operations at shipyards are not included in this subcategory.

4.2 Technology Options

EPA defined specific effluent limitations guidelines and standards for consideration in developing the regulation based on a statistical analysis of the performance of several wastewater treatment technology options. This analysis is described in Section 9 of the *Technical Development Document* and the *Statistical Support Document.*

EPA is establishing BPT pH limitations and daily maximum limitations for two pollutants, oil and grease as hexane extractable material (O&G (as HEM)) and total suspended solids (TSS), for direct dischargers in the Oily Wastes subcategory based on the proposed technology option (Option 6). The technology requirements include the following treatment measures: (1) in-process flow control and pollution prevention; and (2) oil-water separation by chemical emulsion breaking and skimming (see Section 9 of the TDD). This technology is available technology readily applicable to all facilities in the Oily Wastes subcategory. Approximately 42% of the direct discharging facilities in the Oily Wastes subcategory currently employ this technology already.

4.3 BPT/BAT Options for Direct Dischargers

EPA selected the ***Best Practicable Control Technology Currently Available (BPT)*** for direct dischargers in each subcategory based on the average of the best performances within the industry from operations of various ages, sizes, processes, and other characteristics. The Agency considered the cost of these treatment technologies relative to the effluent reductions achieved to assess the cost-reasonableness of these limitations. EPA then considered application of the ***Best Available Technology Economically Achievable (BAT)*** for priority and nonconventional pollutants and ***Best Conventional Pollutant Control Technology (BCT)*** for conventional pollutants. EPA is promulgating BCT equivalent to BPT for facilities in the Oily Wastes subcategory and has decided not to establish BAT limitations.

Table 4.1 shows the technology basis for the selected option for BPT, BCT and BAT for the Oily Wastes subcategory.

Table 4.1: Selected Options For Direct Dischargers: BPT, BCT and BAT

Subcategory	BPT Option	BCT/BAT
For oil-bearing wastes		
Oily Wastes	6	BCT = 6 BAT not promulgated

Source: U.S. EPA analysis.

4.4 PSES Options for Indirect Dischargers

EPA considered ***Pretreatment Standards for Existing Sources (PSES)*** options for regulating existing indirect dischargers under today's final rule. EPA has selected no further regulation for indirect dischargers in all of the defined subcategories.

Wastewater discharges to POTWs from facilities in all subcategories will continue to be regulated by local limits, general pretreatment standards, and 40 CFR 413 or 433, as appropriate.

4.5 NSPS AND PSNS OPTIONS FOR NEW SOURCES

EPA is promulgating ***New Source Performance Standards (NSPS)*** for new direct dischargers in the Oily Wastes subcategory at the BPT and BCT levels. New facilities have the opportunity to incorporate the best available demonstrated technologies, including process changes, in-plant controls, and end-of-pipe treatment technologies, without the cost of retrofitting. EPA considered the same technologies discussed previously for BPT/BAT and PSES as the basis for new source technology. In addition, because new sites may be able to install pollution prevention and pollution control technologies more cost-effectively then existing sources, the Agency strongly considered more advanced treatment options. EPA is not promulgating ***Pretreatment Standards for New Sources (PSNS)*** for new indirect dischargers.

Table 4.2 lists the technology options and exclusions for new direct and indirect dischargers.

Table 4.2: Options For New Direct Dischargers (NSPS) and Indirect Dischargers (PSNS)

Subcategory	NSPS Technology Option	PSNS Technology Option
For oil-bearing wastes		
Oily Wastes	6	No further regulation

Source: U.S. EPA analysis.

4.6 SUMMARY OF THE FINAL RULE AND REGULATORY ALTERNATIVES

The following describes the final rule and the three alternative regulatory options considered by EPA:

- ***Final Rule:*** technology Option 6 applied only to direct dischargers in the Oily Wastes subcategory;

- ***NODA/Proposal Option:*** applies limitations and standards for direct dischargers in all eight MP&M subcategories and pretreatment standards for all indirect dischargers in three subcategories (i.e., Metal Finishing Job Shops, Printed Wiring Board, and Steel Forming & Finishing); pretreatment standards for facilities above a certain wastewater flow volume in two subcategories (i.e., General Metals and Oily Wastes); and no national pretreatment standards for facilities in three subcategories (i.e., Non-Chromium Anodizing, Railroad Line Maintenance, and Shipbuilding Dry Docks);

- ***Direct Dischargers + 413 to 433 Upgrade Option:*** applies the same technology requirements for direct dischargers as the final rule and includes new requirements for indirect dischargers in the General Metals, Printed Wiring Board, and Metal Finishing Job Shops subcategories currently regulated under the Electroplating regulations (40 CFR 413); and

- ***Direct Dischargers + 413 plus 50% Local Limits Upgrade Option:*** applies the same technology requirements for direct dischargers as the final rule and includes new requirements for indirect dischargers in the General Metals, Printed Wiring Board, and Metal Finishing Job Shops subcategories currently regulated under the Electroplating regulations (40 CFR 413) and also includes new requirements for indirect dischargers in the General Metals subcategory that are currently regulated by local limits or general pretreatment standards.

GLOSSARY

Best Practicable Control Technology Currently Available (BPT): effluent limitations for direct discharging facilities, addressing conventional, toxic, and nonconventional pollutants. In specifying BPT, EPA considers the cost of achieving effluent reductions in relation to the effluent reduction benefits. The Agency also considers the age of the equipment and facilities, the processes employed and any required process changes, engineering aspects of the control technologies, non-water quality environmental impacts (including energy requirements), and such other factors as the Agency deems appropriate. Limitations are traditionally based on the average of the best performances of facilities within the industry of various ages, sizes, processes, or other common characteristics. Where existing performance is uniformly inadequate, EPA may require higher levels of control than currently in place in an industrial category if the Agency determines that the technology can be practically applied.

Best Available Technology Economically Achievable (BAT): effluent limitations for direct dischargers, addressing priority and nonconventional pollutants. BAT is based on the best existing economically achievable performance of plants in the industrial subcategory or category. Factors considered in assessing BAT include the cost of achieving BAT effluent reductions, the age of equipment and facilities involved, the processes employed, engineering aspects of the control technology, potential process changes, non-water quality environmental impacts (including energy requirements), economic achievability, and such factors as the Administrator deems appropriate. The Agency may base BAT limitations upon effluent reductions attainable through changes in a facility's processes and operations. Where existing performance is uniformly inadequate, EPA may base BAT upon technology transferred from a different subcategory within an industry or from another industrial category.

Best Conventional Pollutant Control Technology (BCT): effluent limitations for direct discharging facilities, addressing conventional pollutants. Conventional pollutants include biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform, pH, and O&G. BCT is the equivalent of Best Available Technology (BAT) for control of conventional pollutants. EPA evaluates the reasonableness of BCT candidate technologies by applying a two-part cost test: (1) the POTW test, and (2) the industry cost-effectiveness test. In the POTW test, EPA calculates the cost per pound of conventional pollutant removed by industrial dischargers to upgrade from BPT to a BCT candidate technology, and then compares this cost to the POTW cost per pound for similar pollutant load reductions. The upgrade cost to industry must be less than the POTW benchmark of $0.25 per pound (in 1976 dollars). In the industry cost-effectiveness test, the ratio of the incremental BPT to BCT cost divided by the BPT cost for the industry must be less than 1.29 (i.e., the cost increase must be less than 29 percent).

Job Shop: Facilities with more than 50 percent of their revenues coming from work on products not owned by the site. While there are SIC codes associated with some Metal Finishing Job Shops, they sell to a variety of markets and are not a market in and of themselves.

New Source Performance Standards (NSPS): effluent limitations for new direct dischargers based on the best available demonstrated control technology. NSPS represents the greatest degree of effluent reduction attainable through the application of the best available demonstrated control technology for all pollutants (i.e., conventional, nonconventional, and priority pollutants). In establishing NSPS, EPA considers the cost of achieving the effluent reduction and any non-water quality environmental impacts and energy requirements.

Pretreatment Standards for Existing Sources (PSES): categorical pretreatment standards for existing indirect dischargers, designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs. Standards are technology-based and analogous to BAT effluent limitations guidelines.

Pretreatment Standards for New Sources (PSNS): pretreatment standards for new indirect dischargers, designed to prevent discharges of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs. Addresses all pollutants (i.e., conventional, nonconventional, and priority pollutants). Based on the same factors as are considered in promulgating NSPS.

ACRONYMS

BAT: Best Available Technology Economically Achievable
BCT: Best Conventional Pollutant Control Technology
BPT: Best Practicable Control Technology Currently Available
NSPS: New Source Performance Standards
O&G: oil and grease
POTW: publicly-owned treatment works
PSES: Pretreatment Standards for Existing Sources
PSNS: Pretreatment Standards for New Sources